ENGINEERING NEWS.

Tribune Building. New York City.

GEO. H. FROST. PROPRIETOR.
J. W. ADAMS, EDITOR.

SATURDAY. NOV. 5, 1881.

TO OUR READERS.

The rapidly increasing business of this journal, and the desire of its proprietor to meet more fully than heretofore he has done the demand for a high-class civil engineering newspaper in America, necessitates a more complete division of labor in its production than has already existed. To this end Col. Julius W. Adams, Mem. and Past-President A. S. C. E., the well-known civil and hydraulic engineer of Brooklyn, has been placed in charge of the editorial management of ENGINEERING NEWS, the proprietor taking to himself the care of its financial matters. Col. Adams' professional record commences as far back as the year 1832, when he was engaged in railway engineering, and since then he has been actively employed in the survey and construction of railways, water-works, bridges, dry docks and sewers, held the position of City Engineer for the City of Brooklyn for nine years, visited Europe as a Commissioner to examine the water ways there, has been consulting engineer for numerous American cities on the subject of water supply and sewerage, and latterly has appeared before the courts as an expert in matters of hydraulics. Mr. Adams was for some time editor of *Appleton's Journal*, and his latest literary work has been given to the profession in the book entitled "Sewers and Drains for Populous Districts," published last year by Van Nostrand. Col. Adams will continue in the practice of his profession as heretofore; his office and headquarters for consultation will be at his room in this office.

GEO. H. FROST.

SALUTATORY.

The undersigned, in assuming the editorial management of ENGINEERING NEWS, has counted on his numerous professional brethren being as interested as himself in the dissemination of correct information in relation to our public works of all kinds; and that the facts and figures shall be accepted as reliable, it is desirable that the sources of this information shall be unquestioned—that is to say, that the engineer in charge of constructions shall think it worth his while, if not to write himself, to cause to be written, a correct statement however brief, of results attained, as "engineering news" of interest to our readers, and not without value and service to the engineer himself; we should also be pleased to give space to original articles from engineers embodying their plans, views, or criticisms in relation to existing or contemplated improvements, and however they may differ from the views of the Editor, they will be not the less welcome, and we trust the writers will never have occasion to question the fairness with which their communications have been treated.

J. W. ADAMS.

EDITORIAL NOTES.

THE amount allowed by the Board of Estimate and Apportionment of this city for public works for the year 1882 is $3,389,930; the Public Park Department is allowed $644,500, and for street cleaning an even million has been granted. The total estimated expenditures of the city for 1882 is $37,512,063. These estimates have yet to be approved by the Board of Aldermen.

WE publish in full this week the excellent practical paper read by President Metcalf before the Engineers' Society of Western Pennsylvania on the great waste of heat that has been for years and is still continuing in most of the smelting furnaces of the country. Mr. Metcalf ought to know what he is writing about, and we may safely assume his figures as nearly correct as they can be made from the data obtainable. He figures the loss to Allegheny County by waste of heat as over a million dollars annually. What then must the total loss throughout the whole country be?

THE strike of the Amalgamated Iron Workers of Cincinnati, O., which began in June and which has drawn about 2,000 working men into it, and caused a loss in wages of $1,500,000, and nearly $4,000,000 in business, was brought to an end on the evening of the 29th ult. The strikers demanded an increase of 20 per cent. in wages; after five months' idleness they return to work at wages precisely the same as when the strike was begun, and to continue at that rate until June 1, 1882, when "flat" Pittsburgh rates are to be adopted, which are five per cent. lower than the Cincinnati rates.

ATTENTION has frequently been called lately, in view of our present limited supply of water, to the use of cisterns for storing the rain-fall on Manhattan Island, which is stated as 251,000,000 gallons, or three days' supply, in a rain-fall of ½ inch, such as we experienced on Saturday and Sunday last.

To meet all such speculations, we would say that, in the first place, there would be no such amount, were the entire rain-fall of ½ inch collectable, which is not the fact, as much is lost by evaporation and absorption, certainly 30 per cent., and another percentage to the same amount which falls on streets and yards and would be lost for domestic use, leaving but about 63,000,000 gallons as available, or scarcely more than a half day's supply from such a rain, and which, polluted by the sewer gases and impurities of the atmosphere gathered in its descent, would be worth little for domestic use beyond its value for washing purposes; and, to utilize it, would require the introduction of fixtures which, with first cost and maintenance during long intervals of disuse, would prove a tax which had much better be placed in some other direction.

RAILROAD LITIGATION.

The New York, Lake Erie & Western Railroad Company, better known as the Erie Railroad, is petitioner in a suit in which the New York, Lackawanna & Western Railroad is defendant. The testimony on both sides, which is very voluminous and taken before a Commission appointed by the Supreme Court of the State of New York, has just closed, and we await the decision. In the meantime we are at liberty to touch upon the subject matter in dispute, which, somewhat strange to say, has but little reference to ordinary railroad matters, but turns chiefly upon the question of the proper hydraulic formulas to be used in estimating the flow of rivers, and introduces the wave theory to account for an unusual rise in the floods, as observed on the Chemung River in 1865, which river, an affluent of the Susquehanna, in its low stage about three or four hundred feet wide, winds through a valley of extensive flats of alluvium, bordered by high hills, and preserving for thirty or forty miles the same general character. The Erie Railroad located through this valley, was laid originally on a grade rising west, of five feet per mile for fifty or sixty miles, embracing in that distance a portion of the Susquehanna River valley.

At a point about thirteen miles east of Elmira, on the Chemung River, the Erie Railroad follows the south bank of the river. The extension of the Delaware & Lackawanna Railroad to Buffalo crosses the track of the Erie Railroad at this point at an angle of twenty-two degrees, and continuing westwardly straight across the adjoining flat land for three-quarters of a mile by an earthen embankment, crosses the Chemung River nearly at right angles by a bridge of six hundred feet span, thus shutting in a triangular space between the two roads of three-quarters of a mile long by a third of a mile wide at the base near the river, subject to heavy overflow; the apex of the triangle, adjoining the Erie Railroad, being a very oblique bridge opening of one hundred and eighty feet.

The base of the triangle, open to the river, receives the full flow of the flood current. This flood current is very violent, and covers the flats from side to side at high water on a width of some three thousand five hundred feet, and varying in depth, exclusive of the river channel, from five to fifteen feet, the cross section of the river at flood being estimated at from twenty-five to thirty thousand square feet, and a surface slope of the flood-water differing but little from a rate of four feet per mile at this point.

In the flood of 1865 the track of the Erie Railroad at this place was submerged some two feet. It is claimed by the Erie Railroad Company that in the event of a similar flood the effect of the Delaware & Lackawanna bank now being constructed at this point will be to lay their tracks still further under water and interrupt their traffic possibly for weeks. On the other hand, the Delaware & Lackawanna Company claim that the freshet of 1865, so far from being an ordinary freshet, and likely to occur again, was exceptional, having been caused by the breaking of the State dam, at Corning, some thirty miles west, which dam has now gone into disuse, and which caused a wave at this locality, leaving its marks, from which the high water of possible floods, has subsequently been estimated. And, still further, the professional experts produced by the Erie Railroad Company, are charged with having used in their calculation for the flow of the river at flood, and incidentally for the rise occasioned thereby, an antiquated formula, which more modern research has laid aside for something better suited to the requirements of the case.

This antiquated formula, engineers will be surprised to learn, was $v = c\sqrt{RS}$, R being hydraulic radius, S the sine of the slope, and c a coefficient suited to the circumstances of the case. The formula which they claim is better suited to give accurate results, is Kutter's, or

$$v = \left\{ \frac{Z}{1 + \frac{X}{\sqrt{R}}} \right\} \sqrt{RS}$$

in which the coefficient c in the first formula is replaced by

$$\frac{Z}{1 + \frac{X}{\sqrt{R}}}$$

and so far from eliminating the judgment of the engineer, required in the first formula in appropriating values to c, the same or similar reliance upon the judgment is requisite in the determination of a coefficient for roughness of the bed of the river, which enters as a factor in the values of both Z and X in Kutter's formula.

At the Ninth Annual Convention of the American Society of Civil Engineers, a paper by General Theodore Ellis, of Hartford, was read, discussing the value for large rivers of this very formula, by which it appears that in the case of the Mississippi River, introducing the value of the roughness of the bed as given by Kutter for rivers and canals in average order (the only variable in his co-efficient), and using the remaining data as furnished

by Humphreys and Abbott, the velocity of that river at Carrollton would be 5.6 ft. per second, and with the same data, but using the coefficient of roughness for a cement bed, the velocity of the river would be 11.36 ft. per second, and Ellis remarks, "Does any engineer of experience believe that lining the bed of that river with cement, the discharge, with the same area and inclination, would be doubled?" and adds, "The formula, therefore, for large rivers or canals is apparently useless."

This formula for the canals and rivers, from which it was derived, is undoubtedly satisfactory, but like all other hydraulic formulæ, rests for its value upon the judgment of the engineer in its use, and without this discretion is largely exercised is not to be trusted simply on the claim of its originators to universal applicability.

The wave theory has but little foundation upon which to rest. Did the State dam give way like the walls of Jericho, by falling flat like a trap-door, and thus releasing a thousand acres of pent-up water, there might be something of a wave produced, even at the end of thirty miles of river; but the break in the dam, it appears, from the evidence of the State official who repaired it, was but a few feet in width at its commencement, and the material being but ordinary gravel, its enlargement was gradual, and so far from shock being communicated to the water below, which was extended in a wave form, the break furnished but so much additional water to the freshet, to be spread over the entire river for thirty miles. The rise at this distance continued at its maximum height for from six to eight hours, thus losing entirely its character of a wave of high water. We give this brief notice of the case as something peculiar in railroad litigation, and worthy of some attention from constructing engineers, and look forward with some interest to the decision of the court as possibly furnishing matter of interest to our readers.

NEW YORK CITY WATER-SHED.

"A dispatch was received at the Department of Public Works from Croton Lake saying that the rain was falling heavily and that the water in the lake was within eight inches of the top of the dam. A timber coping one foot thick has been placed on the dam and it is estimated that this will save 100,000,000 gallons of water. The full pressure has been turned on at the aqueduct and by to-day the effects will be felt in the lower parts of the city."—*N. Y. World, 3d inst.*

Much misapprehension exists as to the circumstances which limit the present water supply of this city, and as whatever affects the material interests of the city is of importance to the State at large, if not to the nation, no apology is necessary to our city readers for dwelling upon a subject which is not "news" to them—or rather it ought not to be—but, judging from the remarks of some otherwise intelligent residents of the city, we fear the facts are not so fully appreciated as they should be, even here, where the subject is one of vital importance to the every-day life of our citizens.

In the first place the city is receiving to-day all the water which, as a daily supply, it can hope to enjoy for several years yet, and were Lake Erie located above the Croton dam, not one drop more of water could be had for city use than is to-day running through the city pipes, for the simple reason that the aqueduct through which the entire city is supplied, *will carry no more*, and so far from the city authorities being responsible for this, they have labored for years to bring about a different state of things. Every Commissioner of Public Works for several administrations of the city government has stated the facts fully, and done all in his power to educate the people of the State on this vital subject, but thus far ineffectually, and not only is it a fact, well known to such as will inform themselves, that the aqueduct can bring no more water than it is now doing, but it is in daily jeopardy of failing to do even that, for hundreds of thousands of dollars have been expended, and are still being expended, in the effort to prevent this aqueduct giving way entirely and leaving the city without water until it can be repaired.

The reason for the continuance of this disgraceful state of things is not far to seek, but as the scope of this journal does not embrace political matters in any shape, we leave this branch of the subject for other writers.

There is another point equally misunderstood with the first named, and that is, that the Croton basin is inadequate to the supply of pure water to the city in the future, and we hear of schemes gravely announced of bringing water from Lake Ontario, pumping from the Hudson River at Poughkeepsie; or bringing the water from Lake George, and indeed a survey is now in progress, on private account, looking to this latter enterprise. Either of these projects may be feasible; indeed, we know that they are, and if it were necessary it might be worth while to consider them more in detail, but the fact is that the Croton basin, with such additions to its flow from neighboring rivers to the east of it as future wants may render necessary, at a trifling expense, will be ample for the city supply for a length of time beyond which it is needless at the present day to attempt to provide.

This basin is at our doors, and the supply from it comparatively simple in its management. The water-shed of the Croton of 218,000 acres delivers in the dryest year a daily average of near 300,000,000 gallons, and it is entirely feasible by a proper system of storage reservoirs, for which good localities offer, to *insure* a daily delivery of 200,000,000 gallons. When more is needed, the upper waters of the Housatonic River, at a trifling expense may be added to the Croton flow.

All this in detail has been surveyed and estimated, and the Board of Public Works have in their possession all the information requisite to a complete understanding of the problem of the supply of water to the city for generations to come. But of what use is all this water if the aqueduct, in its present shattered condition, is our sole resource for carrying it to the city? Let the Legislature in its wisdom permit the construction of a new aqueduct in the Croton basin of a capacity of 200,000,000 gallons daily, and all the water for the future needs of our city can be had through the Croton Lake.

RIVER IMPROVEMENTS AT WASHINGTON.

Lieutenant Hoxie, of the Engineer Corps, reports to the District Commissioners that the expenditures for operations in the District for the year ending June 30, 1881, were $342,175.68. Among the subjects considered is the reclamation of the Potomac flats. Lieutenant Hoxie says: "Plans for the new river front were long ago prepared and should be urged upon the attention of Congress at the coming session. A sandy flat is forming in front of the city, because the river channel is wider here than is necessary. We have only to fill this sufficiently to change it from marsh to dry land and protect the border by an embankment that will not wash away. If filled a little above high tide it may readily be kept dry by surface drains and flood-valves, and the embankment will keep off the freshets. The filling to a desirable elevation above tide may be cheaply completed afterwards in dredging the river channel." Lieutenant Hoxie also presents a plan contemplating the removal of the steam railway tracks from the streets by tunneling and by the adoption, in some cases, of an elevated railway The cost of making the changes is estimated at $2,365,824.09.

THE ST. LOUIS FIRE SYSTEM.

The committee of five appointed to examine into the workings of the St. Louis (Mo.) Fire Department have made report to the property-owners to the effect that the Fire Department is deficient in equipment; that it should have more engines and better hose; that the discipline of the department is not up to the proper standard; that the water supply is deficient in some parts of the city, and that the building law, which is a very good one, is not properly enforced. In view of these facts the committee say that the rates of insurance will have to be advanced. Another report made by the same committee for the benefit of the insurance companies is said to be much stronger in its strictures than this one.

CALCULATIONS FOR CONSTRUCTING A FLOATING CRANE.

[Translated for ENGINEERING NEWS from *Les Annales des Travaux Public.*]

The putting up of floating cranes is a question which belongs essentially to public works, and the calculations connected with it will doubtless be of interest to all contractors who have to employ such apparatus. The following may therefore be of service to them, the more so that we have not seen any reference to this made in the more popular works.

We have in this case a rotary steam crane on a pontoon, having from the axis of the pivot a span or bearing a, and which is calculated to raise a load q (Figs. 1 and 2). From these data, and supposing that the dimensions and weight of the pontoon are known, as well as the weight of the crane, and the position of the centers of gravity of the different parts, we must determine the inclination that the deck of the boat will take when the jib or neck of the crane will be across the pontoon, and will bear the weight suspended at its extremity. The same calculation may be used inversely for determining the dimensions of the pontoon, if the other conditions have been fixed beforehand. The amount of the found incline will enable us to calculate the maximum effort which the pivot and the other parts of the crane will have to undergo. We have, lastly, to calculate the power requisite for the setting apparatus of the crane, so that it may be made to pivot on itself with the load suspended, and change this load from one side to the other of the pontoon.

We have in Fig. 2 a rectangular cross section of a pontoon, having two plane faces at each end.

Length, L; width, $2\,l$; Q, weight of pontoon with the crane applied at a point A; center of gravity of the whole, h — the uniform down pressure which we would have by bringing all the weight into the axis of the pontoon. Total displacement $= Q + q = 2\,L\,l \times h$.

A will be beyond the medium line of the boat, if, as is generally the case, the boiler is at a certain distance from the axis, so as to balance a part of the load.

The effect of the load may give a certain even position; the total displacement will not vary. The new water line must pass through the point O, the medium of $M\ N$. Let α be the inclination of the deck toward the horizon at the time. Then, let

a be the distance from the pulley at top to axis of boat;
b the height of the pulley at top above $M\ N$;
d' and b' the same co-ordinates for Q applied at A.

We must consider the weight q as concentrated at the highest point of the chain, for this will always keep vertical.

To obtain the *equation of equilibrium* (α being the unknown quantity), we must take around O the sum of the momentums of all the forces acting on the pontoon—that is, the weights from upward to downward, and the pressure from below upward.

We calculate the momentum of the pressure acting on the mass immersed in the form of the trapezoidal prism $M'N'RS$, by taking that of $MNRS$, and by substracting twice the momentum of ONN'. We shall thus have:

(momentum of the load)

$$+ g\,(a\cos.\,\alpha + b\sin.\,\alpha)$$

(momentum of the weight of the pontoon and crane)

$$- Q\,(a'\cos.\,\alpha - b'\sin.\,\alpha)$$

(momentum of the body $MNRS$)

$$+ (Q+q)\frac{h}{2}\sin.\,\alpha$$

(momentum of the two cones ONN' and OMM')

$$-2\,L\,l \times \frac{l}{2}\tan.\,\alpha \times \frac{2}{3}l = O.$$

The inclination a being small, we shall replace $\cos.\,\alpha$ by 1, and, consequently, $\sin.\,\alpha$ by $\tan.\,\alpha$. The solution of the equation will give the value of $\tan.\,\alpha$.

We shall now apply the calculation to the instance before us:

To establish a floating crane of 5,000 kilos.; neck of the crane, 9 meters:

Height of the pulley above the bridge, 8.20 m.

Pontoon: length, 22 meters; width, 8 meters; cavity, 2.35 meters, terminated at both ends by semi-circles.

So as to give more stability to the pontoon we put in a ballast of béton to the height of 0.300 meters from the ground timbers.

This latter will be: 162.2m. + 0.30 m. + 2,000 kilos. = 97,200 t. kilos.

	t. kilos
Weight of pontoon	40,000
" " crane	19,000
" " load	5,000
Total displacement	161,200

$$\frac{161.2 \text{ tons}}{162.2 \text{ m.}} = 1 \text{ meter unif rm draught, if the deck}$$

remained horizontal.

Let us now take the various positions for the loads:

Pontoon 40 tons at 0.50 m. above the sinkage.
Ballast 97 tons at 0.15 m. " " "
Crane 19 tons at 3.60 m. " " "
With boiler and at 0.16 m. from axis of pivot.
Load 5 tons at 10.55 m. above sinkage,
and at 9.00 m. from the axis of the pivot.

For the sake of the calculation we will assume that the pontoon is flat, and we will give it a length of 18.50 m. Applying the preceding equation we have:

$$\begin{aligned} &5 \text{ tons} \times (9\cos.\,\alpha \times 9.55\sin.\,\alpha)\\ &+ 19 \times (-0.16\cos.\,\alpha + 2.60\sin.\,\alpha)\\ &- 40 \times 0.50\sin.\,\alpha\\ &- 97 \times 0.85\sin.\,\alpha\\ &+ 162 \times 0.50\sin.\,\alpha\\ &- 2 \times 18.50 \times \frac{4^3}{3}\tan.\,\alpha = 0. \end{aligned}$$

Replacing $\cos.\,x$ by 1, and $\sin.\,x$ by $\tan.\,x$, there is:

$$41.96 - \tan.\,\alpha \times \frac{42}{713.60} = 0.058 \text{ m.}$$

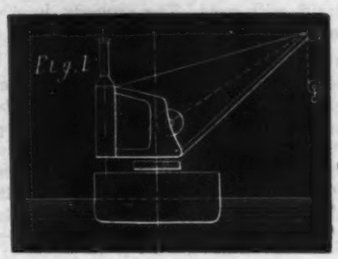
The incline of the deck is therefore 0.058 m. per meter.

We shall then have a lowering of the load of

$$0.058 \times 9 = 0.522 \text{ m.}$$

This being too great, we must put a counterweight back of the boiler, and we will resolve to have only 0.30 m. difference between one side and the other—or 0.30 m. for eight meters, or 0.0375 m. per meter.

By putting 4,000 kilos. at 8.75 m. from the axis, we diminish the numerator of the tangent x by 15; then



$$\tan.\,\alpha = \frac{27}{713} = 0.0378 \text{ m.}$$

We have here only 0.342 of a lowering in the load and 0.304 m. of a difference between one side and the other.

FORCE NECESSARY TO TURN CRANE.

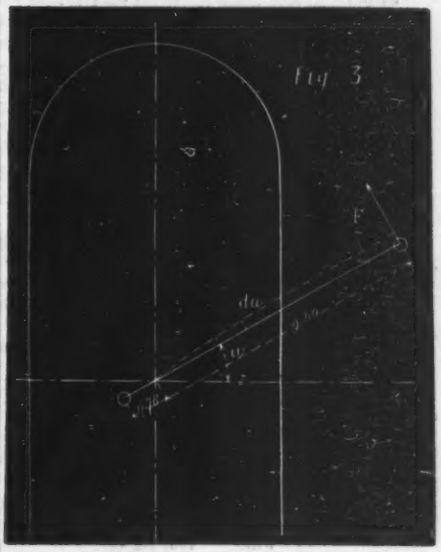
By turning the crane when the jib is crossways, we raise the load (5,000 kilos.) by 0.342 m., and the counterpoise descends a certain distance. In estimating the effect produced and the effort which is to be applied to a given point, we should bring the two weights together and calculate the distance made by the point of application of the resultant. But it is easy to understand that the effort to be made is not constant, and that the load does not raise the same quantity for rotations of the same angle; consequently we must produce a *maximum effort* greater than the *medium*. This medium effort would be, supposing it to be applied horizontally to the end of the neck and normally to its own axis, and taking as weight of the crane 23,000 kilos., applied at 0.78 m. from the axis:

$$F = \frac{5{,}000 \times 0.342 - 23{,}000 \times 0.78 \times 0.038}{\frac{\pi}{2} \times 9.00 \text{ (distance traversed).}} = 72.7 \text{ kilos.}$$

This calculation only gives, as we shall see, but a deficient approximation. In order to elucidate the matter more completely, we shall have recourse to the infinitesimal, which will give us the solution very easily.

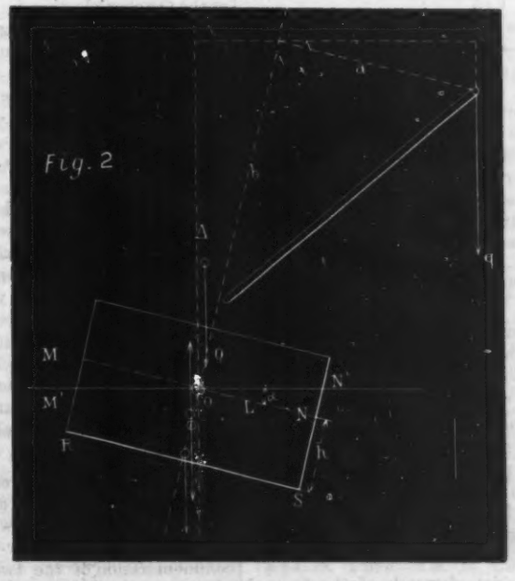
Let us now call F the effort parallel to the bridge and perpendicular to the neck, and which is required to give the rotary motion at a given moment (Fig. 3).

This force in turning the crane with relation to the pontoon will produce a certain rise of the entire apparatus, and of course of the load, as well as a certain fall in the weight of the crane. We can then, if ω is the angle comprised, at the moment in question, between the neck and its initial position, and calling $d\omega$ our infinitely small angle of rotation, which will produce an elevation (dh) of the load and a lowering (dh) of the center of gravity of the crane, consider the neck, the pontoon and the natural forces as a transmission of motion which utilizes the force F to produce a certain work which we can estimate. We do not take



into account the space traversed by the other forces which are infinitesimals of an inferior order.

In the actual condition we will call a the inclination of the deck to the horizon, and we shall have h as the height of the load above the water-



line, and h' as the height of the center of gravity of the crane:

$$h = 9.55\cos.\,\alpha - 9\cos.\,\alpha\sin.\,\alpha$$
$$h' = 2.4\cdot\cos.\,\alpha + 0.78\cos.\,\alpha\sin.$$

(2.48 is the height of the center of gravity of the crane above the water line).

We shall then have as the equation of the determining equilibrium, as before, the angle α.

(Momentum of load) 5×9 ($\cos.\,\omega\cos.\,\alpha + 9.55\sin.\,\alpha$.

(Momentum of crane) $+ 23 \times (-0.78\cos.\,\omega\cos.\,\alpha + 2.48\sin.\,\alpha$.

(Momentum of pontoon) — $40 \times 0.52\ sin.\ \alpha$.
Momentum of ballast — $97 \times 0.87\ sin.\ \alpha$.
Momentum of pressure + $166 \times 0.51\ sin.\ \alpha$.
Momenta of additional displacement — $2 \times 18.5 \times \frac{4^3}{3}\ tan.\ \alpha = 0$.

Or else: $27\ cos.\ \omega - 705\ tan.\ \alpha = 0$.

Whence: $tan.\ \alpha = \frac{27\ cos.\ \omega}{705}$

The elementary work produced by F is:

$$dT = F \times 9.00 \times d\omega.$$

The work produced on the weights is:

$$dT = -5\pi \times dh \times 23^2\pi \times dh'.$$

We replace $cos.\ \alpha$ by 1, and $sin.\ \alpha$ by $tan.\ \alpha$:

$$h = 9.55 - 9\ cos.\ \omega \times \frac{27\ cos.\ \omega}{705}$$

$$h' = 2.48 + 0.78\ cos.\ \omega \times \frac{27\ cos.\ \omega}{705}$$

Whence:

$$dh = \frac{-9 \times 27}{705}\ sin.\ 2\omega\ d\omega.$$

$$dh' = -0.78\ \frac{27}{705}\ sin.\ 2\omega\ d\omega.$$

Let us replace in dT:

$$dT = 5\pi \times \frac{9 \times 27}{705}\ sin.\ 2\omega\ d\omega - 23\pi \times 0.78 \times \frac{27}{705}$$

$$sin\ 2\omega\ d\omega = 27 \times \frac{27}{705}\ sin.\ 2\omega\ d\omega$$

$$F = \frac{dT}{9\,d\omega} = \frac{3 \times 27}{705}\ sin.\ 2\omega$$

F, which varies with ω, is thus *maximum* for $\omega = 45°$. Its value is thus:

$F_M = O^K$, 115 = 115 kilogrammes.

The setting hook or ratch having a radius of 0.85 meters, the necessary effort on the cog to give the rotation will be:

$$115 \times \frac{9.00}{0.85} = 1{,}217\ \text{kilos.}$$

The distance of the cog can then be calculated.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

At the regular meeting of the Society on Wednesday evening, an address of sympathy from the Engineering Club of Rio Janeiro to the American Society of Engineers, on the death of the late W. Milnor Roberts, past President of the Society, was read by the Secretary. The discussion of Phœnixville columns was continued.

PERSONAL.

Thomas Appleton, C. E., of Dover, N. H., has been appointed Chief Engineer of the Leavenworth, Topeka & Southwest Railway, with headquarters at Leavenworth, Kan.

Mr. John C. Chase, Civil Engineer, formerly Assistant Engineer on the New York Elevated Railway, and more recently Assistant Cashier in the Naval Office in this city, has been appointed Superintendent and Engineer of the Clarendon Water-Works, at Wilmington, N. C., where his address now is.

Mr. William Kuebler, formerly of the firm of Kuebler & Seelhorst, manufacturers of engineer's transits and levels, has sold out his entire stock, tools, etc., and good will of business, to Messrs. Jas. W. Queen & Co., of Philadelphia, and is now located with that firm, who are prepared to manufacture his form of instruments.

In the matter of the suit brought by Mrs. Almira B. Coleman against the Manhattan Beach Improvement Company to recover possession of one-fifth of the Manhattan Beach property east of the Oriental Hotel, Judge Cullen yesterday, in the Supreme Court, rendered a judgment for the plaintiff, with costs. The property in dispute is valued at about $100,000.

Mr. D. McN. Stauffer, Mem. A. S. C. E., late engineer for the contractor of the Dorchester Tunnel, Boston Improved Sewerage, has been appointed to a responsible and important position with the Philadelphia Bridge Works, Messrs. Cofrode & Saylor, a wealthy and enterprising bridge company of Philadelphia. Mr. Stauffer's address is 259 S. Fourth street, Philadelphia.

Mr. M. B. Edson, of this city, was awarded letters patent for improvements in Speed and Pressure-Recording Gauges and Alarms on the 12th day of April last simultaneously by both the American and English governments, which, by a singular coincidence, was also the sixty-eighth anniversary of his birth. His combination now being perfected, he rests from his said labors.

Second Lieutenant Rollin A. Ives, Fifth Artillery, died on Saturday, the 29th ult., at Summit, N. J. Lieutenant Ives was a native of New York, graduated from West Point in 1870, when he received his commission as second lieutenant. In 1876 he beame Professor of Military Science at the Western University of Pennsylvania, and later, Assistant Professor of Law at West Point Academy. He was also for a time Assistant Instructor of Artillery Tactics there.

An order in Council has been passed to provide for the family of the late M. Eberts, C. E., killed some months since by falling from a cliff on the Canada Pacific Railroad Survey in British Columbia. Deceased had been promised an increase of salary from $100 to $150 per month. The order gives a gratuity of eighteen months' salary at the latter rate to the family, in addition to the outlay incurred in bringing deceased's family to Ottawa, funeral expenses, etc.

Hon. George Paul, of Cuyahoga Falls, was re-elected member of the Ohio Board of Public Works at the October election by a majority of 25,000, he receiving about the largest vote of any Republican candidate. Mr. Paul is a well-known civil engineer, and the unusual prosperity of the Ohio canal system is largely due to his intelligent supervision. The duties of the office do not occupy his whole time, but leave him opportunity to engage in other professional work, mostly as consulting engineer and expert.

Mr. Theo. D. Randall, late of the New York, Pittsburgh & Chicago Railway, has been appointed Chief Engineer of the Natchez, Red River, & Texas Railroad, with headquarters at Vidalia, La. Mr. Randall has had over forty years' experience in railroad engineering, and is looked upon as one of the most successful engineers in the country. Work will be commenced on the N., R. R. & T. Railroad about Nov. 1. Two swing bridges are to be erected, one to span the Red River and the second across the Wichiti. Judge H. R. Steele, of Natchez, is President of the company.

Mr. W. H. Martin, President of the Copper Queen Mining Company, gave a very enjoyable supper at the Hotel Brunswick, Thursday evening, the 27th ult., to his fellow-classmates of 1856, in commemoration of the twenty-fifth anniversary of their graduation at the Rensselaer Polytechnic Institute of Troy, to which a few personal friends from among graduates of the other classes were invited. Besides the host, there were present of the class of '56 C. C. Martin, the Principal Assistant Engineer on the Brooklyn Bridge; Joseph P. Davis, Vice-President of the Metropolitan Telephone and Telegraph Company; Hiram F. Mills, Hydraulic Engineer, Lawrence, Mass.; James T. Allen, C. W. Boynton, Harvey S. Chatfield, Geo. F. Ells and Edmund Yardley; and of other classes, fellow-students of twenty-five years ago, were Charles Macdonald, President of the Delaware Bridge Company; Francis Collingwood, of the East River Bridge, and Prof. De Volson Wood, of the Stevens Institute, Hoboken.

Vitruvius Frazee, architect, son of the late well-know sculptor, John Frazee, died suddenly lately in San Francisco, where he had lived for the past 15 years. He was a native of New York City, and at his death was in his forty-sixth year, at the height of his powers and with the prospect of a successful professional career before him. The San Francisco *Architects' Journal* speaks in the warmest terms of praise of Mr. Frazee as "an honored and worthy member of the profession, whom every one regarded as an intelligent, earnest and conscientious gentleman." His sickness was caused by exposure in the discharge of professional duty in the Sacramento Valley. By the many friends who knew him well in this part of the country his death will be deeply regretted.

Mr. Francis A. Walker has resigned his position as Superintendent of the Census for the purpose of taking charge of the Institute of Technology in Boston. The presidency of that institution was offered to him several months ago, and he accepted it, so that his leaving the Census Office causes no surprise. The work of the census is sufficiently advanced to require no longer the active control of the master hand. Mr. Walker may be regarded as an excellent model of the scholar in politics. The independence of his way of thinking on political questions could not make him a favorite with the ordinary party man, but his large and varied attainments pointed him out on more than one occasion as a man of eminent usefulness. He was for some time Commissioner of Indian Affairs under President Grant, and left the office for reasons very honorable to himself, and twice he has been put at the head of the Census of the United States, universally recognized as by far the ablest and best equipped man to superintend that important work. The last census was taken under a law the principal provisions of which were devised by Mr. Walker himself, and it may be said to be not merely the most comprehensive and best, but the first really valuable census this country has ever had.—*The Nation.*

Walter Shanly, the well-known Canadian engineer, is dangerously ill at his residence at Thorndale, near London, Ont. Mr. Shanly, who was born in the County Fermanagh, finished the Hoosac Tunnel. He was a member of the Dominion Parliament for South Grenville from 1867 to 1872, when he was defeated. Of late he has been employed by the Dominion Government and by Montreal railroad promoters. His brother Frank, who was engaged with him in the Hoosac Tunnel work, is also in the employment of the Canadian Government.

There was no humility in the mien of the American inventors present. They were free and independent citizens of the United States. Hiram Maxim, who comes from the pinewood State of Maine, has a head expressive of originality of mind and of audacity in carrying out ideas. He has a shock head of iron-gray hair. I believe in shock-headed men. Jablochkoff is a Pole, and tall and young. His strength seems to have all gone into hair and beard. Siemens is a patient savant but not an humble one. Unobservant would be the person who could fail to perceive in him a millionaire, although he is not puffed up by his prosperity. Swann is the North of England man, doggedly persevering, independent, seeing his way clearly, and without conceit.—*London Truth, Oct. 20.*

ERRATA—Obituary—Thomas McElroy, Oct. 29, 1881. James McElroy, employed under William Weston on Wood Creek locks. Samuel Haring, grandson of Thomas McElroy.

BOOK NOTICE.

Manual of the Railroads of the United States for 1881. Fourteenth annual number. Published by H. V. & H. W. Poor. New York, 1881.

During the past fourteen years, Poor's Manual has been the authority in the United States concerning railroads in all their various departments, and has gradually increased and verified its statistics until it comes to us at the present time as an accurate and trustworthy guide for all classes requiring this particular line of information. It has grown with the railroad to its present dimensions of 907 pages, octavo.

The present volume opens with a brief and comprehensive sketch, by Henry V. Poor, of the Rise and Progress of the Internal Improvement and of the Internal Commerce of the United States, with a Review of the Charges of Monopoly made against Railroad Corporations. This has also been published in pamphlet form, which opens with a brief account showing that Washington clearly understood the need of communication between the Atlantic seaboard and the interior. In a letter addressed to the Marquis de Chastellux, dated Oct. 12, 1788, he stated that he had lately made a tour through the upper and western portion of New York, and by his observations was prompted to say: "I could not help taking a more contemplative and extensive view of the vast inland navigation of these United States, and could not but be struck with the immense diffusion and importance of it." Washington was aware of the fundamental reason to which the prosperity of any nation is due, namely, its commercial advantages. He also appreciated the vital importance of extending and cementing these advantages, which tend to the binding together of communities of varied pursuits and nationalities by a bond of common interest, which is indissoluble. In regard to the Western States, he remarked that they "hung upon a pivot," and that "the touch of a feather would turn them any way." The people of that section endeavored to find an outlet down the Mississippi, as it seemed to present a natural solution of their difficulties in reaching a market for their products, but were impoliticly rejected by the Spaniards. It was for the purpose of uniting these people that he advocated the construction of proper highways for transportation, clearly seeing, in the future, the inestimable benefit to be gained, although the first cost appeared enormous.

The author describes the difficulties which surrounded the advocates of the Erie Canal and the various steps by which the work was finally accomplished. He justly attributes the splendid success of the canal "to its singularly favorable route, and to the natural provision for a vast commerce in the great lakes which it connected with tide-water."

The success following the completion of the Erie Canal induced other States to attempt like works, and in 1826 Pennsylvania entered upon a grand system of inland navigation. In 1832 Ohio opened two lines; one from Cleveland to Portsmouth, and one from Toledo to Cincinnati. In 1835 Indiana finished a canal from the junction of the Miami Canal to the city of Evansville. Illinois constructed a canal from Lake Michigan to La Salle. These include all the great water lines built by the States.

Several private works were constructed, the most important and successful being the Delaware & Raritan Canal. "At one time there were 5,000 miles of line (*canal*) in operation, built at a cost of $150,000,000."

The pamphlet gives a concise history of railroading from the time of the "Stourbridge Lion," which was imported from England in 1829 up to the present year, and describes the various changes which were made from time to time in the locomotives and road-bed.

The author concludes with a discussion upon the various phases of railroad monopolies, and presents a history of the movement which started twenty years ago, and has been vainly endeavoring ever since to put railroad corporations under State control, do away with the so-called monopolies, let the State regulate rates, and, in short, relieve a corporation of works which are the result of its money and energy.

The main portion of the manual is composed of statistics of the railroads of the United States, showing their mileage, stocks, bonds, cost, traffic, expenses, organization, gauge, weight of rails and material, together with a sketch of their rise, progress, influence, etc. An appendix contains a full analysis of the debts of the United States and of the several States. Tables of summaries are also given in which, at a glance, collected statements of all the lines may be had.

Taken as a whole, the manual shows an amount of conscientious labor which cannot be estimated, but which has justly resulted in its being accepted as an authority upon all railroad matters.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.*

BY J. JAMES R. CROES, M. AM. SOC. C. E.

CXXIX.—CLINTON.

Clinton, Iowa, is on the Mississippi River, 42 miles above Davenport. The town was settled in 1855 and incorporated in June, 1857.

In 1874, the population being about 7,500, waterworks were constructed by a private stock company, after the plans and under the superintendence of William C. Weir, C. E. Water is taken from the Mississippi River by a conduit carried out to a crib in the channel. The end of the conduit is 15 ft. below low water.

The conduit brings the water to the filter pit, which is divided into two compartments. The filtering material is of sand and gravel, and is held in boxes which can be lowered and raised by machinery for the purpose of cleaning. This apparatus is effective as a filter so long as the water is allowed to pass through it slowly. When large quantities of water are passed it operates only as a strainer of the grosser impurities. Water is led from the filter to the pumps, which consist of a Cope & Maxwell compound direct-acting engine, with low pressure cylinder of 18-in. diameter and 30-in. stroke, and high-pressure cylinder of 10½-in. diameter and 30-in. stroke, with one double-acting plunger pump of 10-in. bore and 30-in. stroke. This engine can be worked with both cylinders high pressure if required. Its capacity is 500,000 gallons in 24 hours, and it is used for domestic pressure only.

There are also two high-pressure engines, with cylinders of 16-in. diameter and 30-in. stroke, with double-acting plunger pumps of 10-in. bore and 30-in. diameter. They can be worked as duplex or single. They were intended for fire service, but work well for domestic pressure.

The engines pump water into a stand-pipe or iron tank placed on a tower 125 ft. high, from which it enters the distributing mains. If desired fire pressure can be had by pumping.

In 1880 the population was 9,068 and the daily consumption 500,000 gallons.

The distribution is by cast-iron pipe from 4 to 16 in. in diameter, of which 8⅓ miles, with 85 fire hydrants and 300 taps were in use in 1878.

The works cost to 1876 $120,000, and the yearly cost of maintenance was about $5,000. Later statistics have not been furnished.

J. B. Howe, C. E., was president and acting Superintendent of the Company in 1875. O. Messer is now the superintendent.

*Copyright 1881.

CXXX.—LYONS.

Lyons, Iowa, is on the Mississippi River, two miles from Clinton. The town was settled in 1840 and incorporated in 1855.

In 1876 water-works were built by a private company, after the plans of W. C. Weir, C. E.

The supply is taken from the Mississippi River and pumped into a reservoir on a hill, by a Knowles pump with 24-in. steam cylinder and 12-in. plunger of 24-in. stroke, and a Cope & Maxwell with 18-in. steam and 10-in. water cylinder, of 18-in. stroke. The reservoir is in excavation and embankment, and is lined with 2 ft. of puddled clay on which is a brick pavement.

Distribution is by 1½ miles of cast-iron and ⅓ mile of 2-in. wrought-iron pipe, with 30 hydrants and 150 taps.

In 1880 the daily consumption was about 50,000 gallons.

The works cost $40,000. The expense of maintenance in 1880 was $1,400, and the revenue $3,600.

H. Gates was superintendent in 1877, and John Gallion is now in that office.

CXXXI.—NIAGARA FALLS.

Niagara Falls, New York, is on the bank of the Niagara River adjoining the cataract. The village, which was first settled in 1759, and was incorporated in 1848, is on level ground.

In 1877 water-works were built by a private company after plans and under superintendence of Benjamin Rhodes, C. E., taking water from the Niagara River.

Water is pumped directly into the mains by a Holly 4-cylinder pump, of 7-in. diameter and 22-in. stroke, driven by a turbine wheel under a head of 30 ft.

Distribution is by cast-iron pipe of from 10-in. to 4-in. diameter, of which 5 miles are laid, 3 miles of which are of less than 6-in. diameter. There are 34 fire hydrants and 340 taps. Meters are not used.

The population in 1880 was 5,048, and the daily consumption 500,000 gallons.

The capital stock of the company is $30,000. The expenditures and receipts for two years have been as follows:

	1879.	1880.
Total construction account	$28,637.85	$29,005.18
Operation account for year	1,880.85	2,353.93
Receipts for year	4,274.51	3,932.37
Dividends paid	1,900.00	2,400.00

Franklin Spaulding is president and Benjamin Rhodes, C. E., the engineer and secretary of the company.

CXXXII.—KEENE.

Keene, New Hampshire, in lat. 42° 55′ N.; long. 72° 26′ W.; is on the Ashuelot River. Settled in 1753, it was first called Upper Ashuelot. It received its present name in 1753. It was incorporated as a city in 1874.

In 1869 water works were built by the town after the plans and under the superintendence of Phinehas Ball, C. E., taking water from a natural lake of 54 acres area, with a water-shed of 1,800 acres, and distributing it by means of a reservoir and gravity.

The conduit is of wrought-iron and cement pipe, 16, 14 and 12-in. in diameter, and connects with the distributing reservoir. The total length from the lake to the town is 3 miles, and the fall 150 ft.

The distributing reservoir, 6 acres in area, is formed by a short dam built across a ravine. Its flow line is 114 ft. above the town.

Distribution is chiefly by wrought-iron and cement pipe. Since 1876 cast-iron pipe only has been used for extensions, and some of the wrought-iron and cement pipe has been replaced with cast-iron. During the summer of 1881 the wrought-iron and cement mains have been struck by light-

ning three times. On one occasion 600 ft. of 6-in. pipe were destroyed; 20½ miles of pipe are in use, with 121 fire hydrants and 885 taps. The amount of 4-in. pipe is not known exactly, but is stated to be too great for efficient distribution.

The population in 1880 was 7,000. The consumption is not known.

The works had cost $162,699.58, to Dec. 1, 1880.

The bonded debt is $150,400.

The expenditure in 1880 was $1,132.94 for maintenance and $2,600 for the extension; and the receipts, $8,487.76. The interest on the water loan, $9,130, was paid out of the general fund of the city, and also $3,000 in redemption of the water loan.

The works are managed by a board of three commissioners. Lewis Holmes was superintendent in 1877, G. F. Sanborn in 1879, and D. H. Sawyer is the present incumbent.

CXXXIII.—MEADVILLE.

Meadville, Pennsylvania, in lat. 41° 38′ N., long. 80° 11′ W., is on the east bank of French Creek. The town, which was settled in 1788, incorporated as a borough in 1823, and as a city in 1865, lies chiefly in the valley, and about one-third of it is on a gradual ascent to the north and northeast.

In 1874-5 water-works were built by a private company, taking water from French Creek, after plans and under superintendence of Robert Cortwright, C. E.

The pumping machinery consists of one double-acting "Flanders" pump with two cylinders, each 11 in. in diameter and 16-in. stroke, driven by an "American" turbine under a head of 15 ft., giving 109 horse-power. Water is derived from the old feeder of the Pittsburgh and Erie Canal.

The lift, including suction, is 285 ft., and the capacity of the pumps 750,000 gallons in 24 hours.

There was added in 1880 one W. H. Lang's improved "Flanders" double-acting double-cylinder pumps, each cylinder diameter 12½ in.; 30-in. stroke; capacity, 1,500,000 gallons in 24 hours.

The pump well is 35 ft. in diameter and 5 ft. deep at low water, the bottom being about on a level with the deepest part of the creek. It has good gravel foundation. The walls are of stone laid dry. The well is 24 ft. from the river, the earth for this distance being excavated and the trench filled with gravel, acting as a filter. The gravel has to be renewed about every four years. The pumping main is of 12-in. cast-iron pipe 4,400 ft. long.

The reservoir is built on a slightly sloping surface in excavation and embankment. It is 285 by 150 ft. at the top and 24 ft. deep. The banks are 9 ft. wide on top with slopes of 1¾ to 1. The bottom and inner slope is covered with clay puddle 12 in. thick, covered with a brick paving laid on 1 in. of gravel and grouted with cement. There is a division wall 10 ft. high.

Distribution is by cast-iron pipe, of which there were on Nov. 1, 1881, 15½ miles in use, with 100 fire hydrants and 806 taps. About 7½ miles of the pipe are of less than 6 in. diameter.

The population in 1880 was 9,000, and the daily consumption 280,000 gallons. The works have cost $145,000. The capital stock of the Company is $125,000. The expenditures for the year 1880 were for maintenance and repairs $3,153.79, and for new construction and dividends $22,294.64. The receipts were $25,448.44.

J. D. McGill is president of the company; H. L. Richmond the secretary and George S. Cullum the superintendent.

(TO BE CONTINUED.)

We acknowledge with thanks the receipt of data as follows: From Benjamin Rhodes, Engineer and Secretary, statistics and water rates of Niagara Falls Water-works. From O. Messer, Superintendent, water rates and partial statistics of Clinton (Iowa) Water-works. From D. H. Sawyer, Superintendent, statistics of Keene (N. H.) Water-works and seventh annual report of City Government. From G. S. Cullum, Superintendent, statistics and By-laws of the Meadville (Pa.) Water Company.

CORRESPONDENCE.

WELLINGTON'S ECONOMICAL THEORY OF RAILWAY LOCATION.

C. H. T., Wilkesbarre, Pa.—The publication of the above book is postponed indefinitely. Mr. Wellington is in Mexico, and it will be a long time before the book is issued, if, indeed, it ever is again.

EXCAVATION AND EMBANKMENT TABLES.

WISCONSIN & MICHIGAN RAILROAD CO.,
OFFICE OF CHIEF ENGINEER,
GREEN BAY, Oct. 30, 1881.

EDITOR ENGINEERING NEWS:

Can you inform me if the "Engineers' Excavation and Embankment Tables," recently issued, embrace road-beds of 14 and 22 feet? What is the price and where can they be had? Pullen and Chandler authors. Very truly, yours.

R. CRAVATH.

The tables in this book are for bases 12, 14, 16, 18 and 20 feet only, with slopes ¼, ½, 1 and 1½ to 1. The price is $3, and the book is for sale by the J. M. W. Jones Stationery Co., Chicago, Ill.

EXCAVATION AND EMBANKMENTS.

PHILADELPHIA, Oct. 27, 1881.

EDITOR ENGINEERING NEWS:

There seems to be a difference of opinion as to the relative size of cuts and fills. With some, the filler occupies more space, and with some less than the cut. If you were measuring excavation without the original data, what would be your rule in regard to it?

2d. Will the earth excavated measure more or less in the fill than it did in the bank?

3d. If the earth for fills has been taken from small patches along the road, where the excavation cannot be measured, how do you determine exactly the amount excavated?

4th. What is the difference in settling between dumping out at one end and carrying the work on grade, or by running dumps in layers, in a filling, say of 10 feet?

If you will give these questions insertion in your paper, will oblige a SUBSCRIBER.

FIELD BOOK ON METRIC SYSTEM.

CITY OF MEXICO, P. O. Box 300,
Oct. 17, 1881.

EDITOR ENGINEERING NEWS:

Have you any field book similar to Henck's R. R. work, with tables, etc., in the metric system? All the roads here are compelled by law to adopt the metric systems of measurements, and I think such a work would meet with a ready sale.

Yours truly, C. H. M. BLAKE.

We do not know of any book such as Mr. Blake refers to. We published in ENGINEERING NEWS of July 5, 1879, an article by Emile Low, then Chief Engineer of the Pittsburgh & Western R. R., on "The Application of the Metric System in Laying out Railroad Curves." Mr. Low is now at Guanajuato, Mexico, and by the last mail we received from him the above article reprinted in a little eight-page pamphlet, for which we advise Mr. Blake to write Mr. Low. We recommend also correspondence with that valiant champion of the metric system, Mr. Fred Brooks, whose address, Oct. 6, was "In Camp in the State of San Luis Potosi; P. O. address, Tampico, Mexico."—ED. ENG. NEWS.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE annual meeting of the American Society of Mechanical Engineers was called to order by its President, Prof. Robert H. Thurston, at 8:15 p. m., Nov. 3, in the theatre of the Turf Club, corner of Madison avenue and Twenty-sixth street, this city.

The programme consisted of an afternoon and evening session on Thursday, a morning and afternoon session on Friday and a subscription dinner at Delmonico's on Friday evening. The papers announced to be read were as follows: "A Mill Floor and its Supports," by C. J. H. Woodbury; "Fire Potection of Mills," by the same gentleman; "A Self-Packing Valve," by H. F. J. Porter; "Standard Weights and Measures," by Mr. Partridge; "A New Method of Keeping Drawings," by Charles T. Porter; "Observations on Railway Structures from Ohio State Railway Service," by Prof. S. W. Robinson.

POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

At the meeting Thursday evening, the 20th, T. D. Stetson, Esq., presiding, the regular subject of the evening, "Lenses," was opened by Prof. F. G. Fairfield, who said he was not a maker, only a user, of lenses. Users often differed in their estimate of things from the manufacturers. With lenses, and he thought with most articles, users set a lower value on extra refinement. His familiarity with lenses was in microscopy. The world had progressed immensely through the more recent improvements in microscopes. We have got what we term living flesh and blood reduced to a mass of inert material inhabited by minute, moving objects, in which latter alone is the active life principle. These only are really alive.

The improvements in the microscope have been gradual. Singularly each step in improvement has led to changes in the theory of microscopic physiology, and yet we have in some cases found afterward the same facts could be observed almost or quite as well with the older form and arrangement of lenses. Quite recently the introduction of a system of lenses with short focal distances, one-sixteenth of an inch and less, had led to the discovery that human saliva is filled with flat, nearly transparent, irregular corpuscles. That being done, we go back to our previous systems of triple lenses, and find we see and define them nearly as well.

Professor Clark, of Harvard College, had shortened the focus to one thirty-secondth of an inch, and in his work, "Mind in Nature," had given an impulse. Professor Beal, of London, had responded with a higher power and with great ingenuity and facility of recourse in overcoming difficulties involved.

Professor Tolles, in this country, had reached the limit of short focus by giving us a system of lenses one seventy-fifth of an inch focus. They were tolerably successful. Less than that would not allow a proper covering glass or mica for the object. The field of view in those lenses is only a six-hundredth of an inch in diameter.

Very high powers are not adapted for study of living matter, yet, with certain limitation, the higher the power the less the vibrations observed in the particles. Good eyes, unaided, could distinguish objects one three-hundredth of an inch in diameter. Skillful microscopists, with the best instruments and conditions, study the forms, colors and nature of monads only one one hundred-thousandth of an inch in diameter.

The speaker had one favorite system of lenses, not very short focus; it was one-tenth of an inch, but it was on a new principle, which he hoped much from. He could not only see blood corpuscles, but could observe irregularities in their forms and particles of fibrine adhering to them. He had only two lenses and a condenser. It required a finer stand than ordinary.

There is much speculation on the ultimate sizes of the elemental particles of which all matter is shown, by chemical demonstrations, to be composed. They cannot be more than one twenty-millionth of an inch in diameter. Some, or all, are probably much less.

There seems to be no limit to the magnifying power of microscopes. It is, in the present state of the art, at about a hundred thousand diameters, or from seventy-five thousand to a hundred and twenty-five thousand. We have no exact way of thus comparing with the views by the naked

eye. About the best is the apparently barbarous one of placing one eye to the instrument and looking at a finely graduated plate of known dimensions, and looking with the other eye at a common foot rule at a proper distance for ordinary sight, and with practice bringing the objects together in the field of view.

A gentleman asked the object of recent improvement in the electric light on microscopic science. Prof. Fairfield said it made it possible to illumine 500 times stronger than gas. Prof. Keith said it was perfectly practicable to go far beyond that, and the light had some qualities which made it superior in other respects.

The President asked the effect of heat in possibly disturbing the action, particularly in the biological observations, with the light from any sources so greatly concentrated. Prof. Vanderweyde described Chevalier's method of separating the light by its difference in refrangibility so that the heat rays were nearly excluded and the luminous rays alone were thrown on the minute object to be examined.

Mr. Chapman explained a difficulty to be met in the ultimate approach to observing the absolute constitution of matter in the vibration due to the undulatory nature of light itself. Practice had not reached it yet. But it would be met before they ever magnified to see the chemical constitution.

Prof. Phin attached more importance to the angle of aperture and to the correction of the lenses so as to work with large aperture than he did to simply great magnifying power. The late lamented Charles A. Spencer did his best and most extraordinary work with lenses of more than 1-15 inch focal length. He showed by cutting out a section from the middle of a diagram how the same magnifying power may have a smaller field.

Prof. Fairfield thought there were reasons to believe that the common house-fly, with its numerous lenses, capable, as has been lately proved, of change of focus, like the human eye, by a circular muscle overlooked by early entomologists, could avoid the serious difficulties we meet with in high powers, and could distinctly recognize objects only a twenty-millionth of an inch in diameter.

NEW YORK CITY WATER SUPPLY.

[From the Times of Oct. 30.]

The excitement concerning the water supply for the city, and the dangers that might follow a continuation of the drought, gives interest to the forgotten history of the subject of supply, and the various plans proposed, tried and abandoned before the authorities finally undertook to bring in the water of Croton River. A dozen years before the commencement of the Revolution the need of more water than the ordinary wells could supply was felt, and some indefinite plans were canvassed. The city then hardly came up to the City Hall Park, but danger was apprehended from fire—such a fire as came soon after the British took possession in 1776, whereby nearly all the west side, from Broadway to the Hudson, and from below Rector to Dey street and further up, was destroyed, Trinity Church included.

In 1774 Christopher Colles (who was interested for many years afterward on the subject) proposed the construction of reservoirs and the laying of wooden pipes through the principal streets, and after long discussion the Common Council consented. Colles proposed to dig wells for the supply, and to construct a large reservoir on the east side of Broadway, between Pearl and White streets, into which the water should be pumped. Some wells were dug and the water proved to be good, under which encouragement the Corporation issued bonds to pay the expense. But before any considerable progress had been made the war of the Revolution begun, the operations of Colles was suspended, and there was nothing more done about water supply until the spring of 1785, when Samuel Ogden proposed to erect works to supply the city. Nine months later (January, 1786), Robert R. Livingston and John Lawrence made a proposition for the same purpose. It does not appear that either proposition was considered; but soon afterward the Corporation advertised for proposals to furnish the needed supply. This, however, came to nothing. In January, 1788, petitions were sent to the Common Council in favor of the carrying out of the plans proposed by Colles, but no action was taken. In February, 1792, Zebina Curtis and others proposed to furnish water, but the record says nothing more of their proposition. In March, 1795, Samuel Crane proposed to take the supply from the famous tea-water pump and convey it through Roosevelt and other streets in pipes. This pump was near the junction of Chatham and Pearl streets, and was famous for the bountiful supply and excellence of its water, which was carted around the city and sold to housekeepers. From the water's supposed superiority for making tea the pump got its name. But not many years after the date here alluded to some wicked investigators declared that the superexcellent water really came from the Collect Pond, and was no better than sewer drainage strained through sand and gravel.

On the 1st of February, 1796, the Common Council advertised for proposals to supply the city, and several offers were made, but no definite action was taken. A year later another advertisement brought seven or eight propositions, which were buried in committee. In December, 1798, R. J. Roosevelt and Judge Cooper (of Otsego County) made proposals. Up to this time no one seems to have thought of going beyond the city—certainly not beyond the island—for water. They all relied on old or new wells, the tea-water pump, or the Collect Pond. This pond occupied nearly one-third of the present Sixth Ward, between about Baxter and Elm and Pearl and Canal streets, and was drained into the North River by an open ditch through Canal street. It was deep near the site of the Tombs, and the water was necessarily filthy, as the pond took in a great amount of street drainage.

On the 17th of December, 1795, the Common Council got the first glimmer of the possibility of going beyond the island for water, and turned their attention to the sluggish little Bronx River—now little more than a meadow brook. It would furnish an abundance for the city of 30,000 inhabitants, and its water was singularly pure. The river and surrounding country were examined, the idea was deemed feasible, and the Common Council determined to apply to the Legislature for the necessary power to issue bonds and go on with the work. The city had been scourged with yellow fever and some of the doctors in their wisdom decided that the disease was promoted (some said caused) by the poor quality of water then in use. The first plan, with the Bronx for a base, was to bring the water to Harlem River at an elevation of 80 ft. above tide, and force it into a reservoir which was to be made near the Dove, a well-known public house about 5 miles miles from the city proper. From this reservoir pipes would be laid in the main thoroughfares, and another reservoir was to be built in the City Hall Park or above the hospital on Broadway.

Just as this plan seemed to be on the way to success, Aaron Burr (then a member of the Legislature), conceived the idea of the afterward famous Manhattan Bank job. Under the specious pretext of forming a company "to supply the City of New York with pure and wholesome water," he proposed a bill the real object of which was to charter a great banking-house. Protests were sent up by the City Government and by the most eminent citizens; but Burr was not the man to be foiled, and he easily secured the passage of his charter. The best that the city could do was to take a hand in the game, and so the Common Council took 2,000 shares of the stock. Nothing was done with the Bronx River project, nor were any new projects broached for several years. Although authorized to go over all New York island and all Westchester County for water, the Manhattan Company confined its operations to the lower and thickest-settled part of the city, where money could be made by the sale of water. They sunk a single large well near the corner of Duane and Cross streets (City Hall place), and, instead of "pure and wholesome water," gave their customers the drainings of the Collect pond. Some feeble efforts were made to hold the company to its promise, but the managers laughed at the people and did nothing more.

It was not until after the peace of Ghent that further efforts were made for a water supply. In 1816 Robert Macomb and others proposed to build a reservoir near Harlem River and pipe the water down from Rye Pond. This project came to nothing. Six years passed, and in April, 1822, a commission, headed by Stephen Allen, reported on plans looking to Rye Pond, the Bronx and Mill Brook, but again nothing was done. The next year developed a grand idea, which was no less than the bringing of water from the Housatonic River into the city to supply factories and houses, wash streets and put out fires. Before the notion was fairly understood it was proposed to dig a canal from Oblong River at Sharon, Conn., to Dover, Dutchess County, N. Y.; thence down the valley of Swamp River, through Putnam County, to Crawford's Mills, on the east branch of the Croton; thence to Macomb's Dam, on the Harlem River, passing through two tunnels 1,320 and 1,760 yards long—the whole length 52 miles—and the water at Harlem River to be 97 ft. above tide. This plan was approved by the Legislature, but it was much too expensive for the time—the capital could not be raised, and the project went the way of its predecessors. In the next year the Bronx was again attacked, but with no result.

In 1825 the Legislature incorporated the New York Water-Works Company, the plan of which was to bring the entire Bronx River in an arched conduit to the bank of the Harlem, put it under or over in some way, and then distribute through pipes. It was a short-lived notion, for almost as soon as it was born the Sharon Canal Company shut down upon it with a claim to all the water on the route of their proposed canal.

Thus driven from the country, the water-seekers dreamed that they could get an abundant supply from wells on the heights near Harlem. A number of wells were sunk, but the supply of water was insignificant, and this project went overboard.

The next idea was for artesian wells. Levi Desbrow had bored one near the corner of Bleecker and Mercer streets 442 ft. deep, and had got a fair supply of good water. He had made others with success. He proposed that such a well should be bored in each ward, and the Common Council had trials made in most of the public markets and other places. The supply of water was not found, and the artesian well was voted a bore. One success, however, the City Fathers did have. In or near Jacob street, in "the swamp," after boring 128 ft., they came upon a "mineral" spring. The water was unpleasant to the taste, but the idea got abroad that it was medicinal and a sort of cure-all for every kind of disease. The people flocked to the spring and drank their fill—of what? Simply the drainings from the tan vats at the surface where the swamp men soaked their green hides.

The city was growing rapidly, and no one could be insensible to the necessity of water in case of serious conflagrations. There were 40 public cisterns, each holding 2,000 gallons, but in a conflagration such a supply would be but a drop in the bucket. At this period Alderman Sam Stevens proposed a well and reservoir in Fourteenth street, the reservoir to hold 2,000 hogsheads, pipes to take the water down the Bowery and Broadway to Chatham square and Canal street. The record is wanting here, but we believe the work was undertaken, or at least authorized. It might have been abandoned when the Manhattan Company made their well and reservoirs in Thirteenth street near Fourth avenue.

In 1830 Francis B. Phelps made to the city a number of propositions, as follows: First—To tap Rye Pond with a 28-inch pipe. Second—To make an open canal from the Croton River, or to use iron pipes. Third—To bring water from the Passaic above the falls at Paterson, crossing the Hudson River in iron pipes laid on the bottom. Fourth—A plan not developed, but depending on wells and springs on the island. About this time there was much complaint of the Manhattan failure, and in 1831 an effort was made by the Common Council to get a repeal of the company's charter. It was not successful, however. At this time, too, the idea that water sufficient for the city's needs could be got on the Island was given up. It has never been revived. The formation of Manhattan Island and the surrounding country forbid the idea that flowing wells can be found. There may be a flow for a time, but it will soon stop, and many wells soon dry up entirely. The artesian well of the Manhattan Company in Thirteenth street was the most prolific of any, but it supplied only 20,000 gallons in a day. It was conceded on all hands that water must come from the country north of us or from New Jersey. Occasionally the Croton was thought of, but the expense was deemed too great, and so the public again turned to the Bronx. In January, 1832, the Common Council approved a plan for getting water from that river, and applied to the Legislature for authority, but it was not granted, the expense being considered too great.

On Nov. 10, 1832, "Col. DeWitt Clinton was directed" to explore the country toward and along the Croton River, and also along the Bronx, around Rye Pond, and other places as he might deem proper. On Dec. 22 he reported that he had come to the conclusion that the city must rely upon the Croton River and its tributaries—a conclusion differing from that of all other surveyors. In January, 1833, the Common Council prepared a bill which was passed by the Legislature Feb. 26, and immediately afterward the first Croton Commissioners were appointed by the Governor. All other water projects were abandoned, work was begun immediately, and on July 2, 1842, the Croton was flowing under and on the main streets of the city. The little Croton has served New York

nobly for 40 years, but it seems that another source of supply must soon be sought. It is a but a question of time when the metropolis will have to tap Lake George or Lake Ontario.

WASTE OF HEAT.*

It is not the purpose of this paper to go into a discussion of the theoretical quantity of heat to be obtained from a pound of coal, as compared to the actual amount obtained. All this is to be found laid down in the books over and over again, to stimulate engineers to try and stop the enormous loss shown, and many of the ablest men of the world are working at this fruitful problem. A far more odious and obvious comparison is intended; one that is ever present to us in the shape of huge volumes of smoke, and bright but expensive bonfires that are pouring out of the tops of our furnace stacks, day and night. It is proposed to show by figures obtained from actual working data how much money is annually thrown away in Allegheny County by throwing money into our furnaces in the shape of coal, to be sent, wasted, out of the tops of stacks in the shape of dirty, useless smoke, and red and far more expensive flames.

The data of the old style furnaces are obtained from some of our ablest and most reliable iron manufacturers. The data of the new style furnaces are obtained from personal experience, and from a few iron makers who have tried and who are adopting the new style furnaces. By the old style furnace is meant the ordinary reverberatory furnace; and by the new style is meant any good regenerative gas furnace. The data of quantities of iron made are taken from the paper of William P. Shinn, on "Statistics of Pittsburgh Manufactures," read before the American Institute of Mining Engineers in May, 1879.

The price of fuel is assumed as the probable average cost of the fuel laid down at the furnace. If the price should be too high or too low in any case the correction can easily be made for any particular mill by parties interested. In stating that forty bushels of coal are used in puddling a ton of iron, I am well aware that many iron men say puddling can be done, and is done, with thirty bushels per ton; but on the other hand some of the very best and most experienced men say that forty bushels is nearer the actual figure of the amount used. Again, I have placed the quantity of slack used in a gas furnace at twenty bushels per ton of iron, which is the highest quantity I have over known to be used, while I know that fifteen bushels is nearer the actual consumption, and there are furnaces now building which I believe will produce regularly a ton of such iron with ten bushels of slack.

For the gas furnaces these figures include the consumption of fuel and wages of gas makers from Saturday noon until Monday morning, during which time the gas furnaces are kept hot, and are idle. For heating I have used equal quantities of coal for one style and slack for the other, as given by iron men, although I am satisfied that this is an error in favor of the reverberatory system; but not having measured these quantities myself, I take the data of those who have made the comparison by actual measurement. I would call your attention particularly to the enormous difference by loss in oxidation, or scaling:

We have then for puddling:	
Old style—Coal, 40 bushels at 6 cents	$2.40
New style—Slack, 20 bushels at 3 cents	60
Difference in fuel	$1.80
Deduct for gas making	42
Saving in fuel in puddling one ton	$1.38
Re-heating.	
Old style—Coal, 18 bushels at 6 cents	$1.08
New style—Slack, 18 bushels at 3 cents	54
Difference in fuel	54
Deduct for gas making	21
Saving in fuel per ton	33
Loss by Oxidation—Scaling.	Lbs. per ton.
Old style, 10 per cent	224.0
New style, 6 per cent	134.4
Saving in iron by scaling	89.6
89.6 lbs. at 2½ cents	$2.24
This gives us:	
Difference per ton of musk bar	$1.38
Difference per ton in fuel, for heating	33
Difference per ton in scaling, for heating	2.24
Total saving in one ton of bar iron, once reheated	$3.95

Mr. Shinn's paper gives the quantity of rolled iron produced in Allegheny County in 1878 as 252,083 tons of 2,240 pounds. Assuming this, and multiplying by the figures we have just given, we have:

Loss in puddling 252,083 tons, $1.38	$347,873.54
Loss in heating, in fuel, 252,083 tons, 33 cents	83,187.39
Scaling, 252,083 tons, $2.29	564,665.92
Total loss	$995,727.85

An iron maker who was consulted in the matter estimated that 25 per cent. of the iron made is twice heated. Assuming for this quantity one-third of the above difference in scaling as a probably safe estimate, and all of the difference in fuel, we have 74.6 loss for scaling and 33c. for fuel, equal $1.07.6 as the total loss in this operation. Twenty-five per cent. of 252,083 equals 63,020 in round numbers, and 63,020 multiplied by $1.07.6 equals $67,809.52. Adding the above total, $995,727.85, we have $1,063,537.37 as the total annual price paid in Allegheny County for the bonfires we keep at the top of our furnace stacks.

At first glance it may seem incorrect to assume the loss in scaling at 2½c. per pound; you will understand, of course, that there is no way of getting at exact selling prices, and it is probable, when we consider how much iron goes into special forms, that the "card" is about the average price. Again, the selling price is proper because the manufacturer loses the material that scales away, less only the value of tap cinder. The workman loses the wages of this amount, because it would increase neither his hours nor his labors perceptibly if the additional yield were made. And finally, the manufacturer loses the profit of this amount, as its sale and distribution would not increase his expense account.

These figures are enormous, and fairly open to criticism, yet I know of one instance where a careful record of several gas furnaces which cost from $10,000 to $15,000 each showed that each furnace paid for itself every year, and of another case where a furnace which is not as well arranged as it ought to be, and which cost less than $6,000, showed a daily saving of $56, or about $15,000 a year; and of another case where the gas system was only partially in use, where there was a saving in the total annual fuel bills per ton of product of 46 per cent.

Several questions will naturally occur; such as, What is the wear and tear? How much fix does the new style furnace consume? What is the cost of a gas furnace? Will not slack increase in price? What sort of heat do you get? Is the work as good? etc., etc. As to wear and tear, I believe it to be much less in a gas furnace than in a reverberatory.

A careful record of one run of a puddling furnace when 525 tons of muck were produced showed that the total cost of rebuilding, including castings, bricks, fire-clay and all wages, amounted to 82 cents per ton. For heating I have no figures, but I know of one furnace that ran six years, alternately heating iron and steel, before the crown gave out, and then only about one-third of it had to be replaced, and during those six years I do not think $50, all told, were spent for little repairs, such as relining the doors.

In puddling strong pig containing not over 2 per cent. of silicon, about 850 lbs. of fix, wet weight, are used per ton of muck.

Gas furnaces, including producers, but not including royalties, can be built for about the same cost per ton of capacity as ordinary reverberatory furnaces. Slack might increase in price if all the mills of Pittsburgh used only slack, but it is not likely that much increase would occur, because it is difficult for the river mines to dispose of a large part of their slack; and again, the run of mine-coal works so much stronger than slack in the producer that it can be used at about the same cost per ton of yield of furnace. The gas heat is uniform, continuous and very soft; iron comes from the furnace thoroughly heated through without being burnt, so that the usual exclamation of the men is, "It is as soft as butter." The work done in the gas furnace is on the whole much better than that done in a reverberatory furnace, because the heat is more uniform, and it requires the grossest carelessness to burn iron in a gas furnace.

Besides, the work is so very much easier for the men that they naturally do much better work, because their labor is not so exhausting and they take more interest in it. This is a point of no little importance, for it is easy to obtain a very high quality of finish at no increase of cost; and when men are contented the troubles of the "bosses" are very light. No account has been taken of the wages question, because with the above stupendous figures it is a question not worth considering in this connection, but it is a fact that men can do from 10 to 20 per cent. more work on a gas furnace than on a reverberatory; they can do it easier and they can do it better.

Therefore the new style gives the working man a chance to make money, too, without interfering with present lists, and the gas system requires as many hands as the other, if not more; therefore, its introduction need cause no opposition.

It is suggested that the publication of this paper, if the statements given are all correct, might injure Pittsburgh by inducing outside manufacturers to adopt this gas system. The fact is shrewd manufacturers from parts of the country as widely separated as New England and the Pacific slope have visited Pittsburgh repeatedly; have examined this system carefully, have adopted it extensively; have written back that they were delighted with it, and were pushing their changes rapidly. Under these circumstances it is barely possible that it is worth our while to look to our laurels.

In conclusion, I wish to say that I do not want to be understood as claiming to be, in the works with which I am connected, in advance of the rest of the world. We still use some of the wasteful style of furnaces, and a complete emancipation from the old ways is always difficult to accomplish, but we are making as rapid a development of the use of regenerated furnaces as we can.

One field for the regenerative gas system is still unoccupied; I refer to the firing of steam boilers. Some Germans have recently shown that by gas firing 90 per cent. of the fuel will evaporate double the quantity of water in a given boiler.

This simply means that any concern can double its steam-producing capacity at a very trifling cost, and with no increase of plant.

A battery of boilers is now being fitted in this city with regenerative gas fires, and if the results named by the Germans are realized, the facts will be laid before the society at an early day.

In the meantime the subject commends itself to everyone who is interested in economy and cleanliness.

The economical side of the question has been shown; the cleanly side is accomplished of necessity; first in the greater cleanliness of the works, and second from a reduction of the smoke nuisance, for it is well understood by all who know how to work a gas furnace that a smoky stack is a sure sign of a furnace that is in bad order; therefore smoke from a gas furnace is always inexcusable.

* A paper read before the Engineer's Society of Western Pennsylvania by Wm. Metcalfe, President of the Society, on the 16th ult.

THE PANAMA CANAL.

The first annual meeting of the Panama Canal Company, in Paris, set for Sept. 8, did not come off, but a meeting, it is reported, was held on the 10th of September in Paris, at which they decided to purchase the Grand Hotel in Panama for $206,000, or 1,000,000 francs at the present rate of exchange—just about double what it would bring at a forced sale. As the sale was "in the family," it is all right! The company, however, seems to have reconsidered the advisability of asking for $30,000,000—being two-thirds of the balance due by subscribers—and has given notice that the second call of 125 francs per share is made payable from the 2d to the 15th of January next. It also informs the shareholders that the interest coupon No. 2, due Jan. 1, may be applied as part payment of call No. 2. Now it remains to be seen how much will be paid in. A clause in the general secretary's notice seems to intimate a difficulty in getting the money. The notice states that in default of payment interest will be charged for each and every day after Jan. 2.—*N. Y. World Correspondence.*

HOW CROTON WATER IS WASTED.

The inspectors of the Department of Public Works are busy searching for houses where water is wasted. Their method is to have a man enter a sewer in the night-time through a man-hole and apply a gauge to the water flowing into the sewers from houses. In cases where the flow is great an inspector is sent to the house the next day to examine the plumbing. When a serious leak is found the water is cut off summarily. In this way a number of houses have been deprived of water within the last few days. The police have been notified to be especially vigilant to prevent the waste of water, and the result of the order has been that several houses have been reported. In one case yesterday the water was cut off from a row of three houses on a police report. The water will not be let on again until the owners or occupants take measures to prevent waste. The officials of the Department of Public Works find

the most fault with apartment houses. One of them visited by inspectors had a tank on the top floor containing 3,300 gallons of water. This was filled and emptied twice a day, making the water supply 6,600 gallons a day. Ten families live in the house, so that 660 gallons are used by each family, which is considered an excessive amount. This does not include hot water, which is supplied from boilers in the basement. The officials have no power to limit the supply unless a waste of water can be shown. Some trouble is experienced by the inspectors in gaining admittance to houses in the daytime, as servants object to letting them in while their employers are out.

A SAFE AND ECONOMICAL DAM.*

We give in connection with this chapter an illustration representing a style of dam which can be confidently recommended for its durability, and which involves no excessive outlay either of money or labor. It has points of resemblance to the log dam described in our last chapter, but the dam referred to is particularly suited to a region where timber is abundant, while the one here shown does not require so ample a supply of that material. The abutments of this dam, it will also be observed, are built of stone, instead of crib-work, as in the former case. Crib-work, however, can be substituted if more convenient; or if stone is used, cap-rock or rubble will answer the purpose, if compactly laid and filled with earth solidly in the rear, nearly as well as more costly building stone.

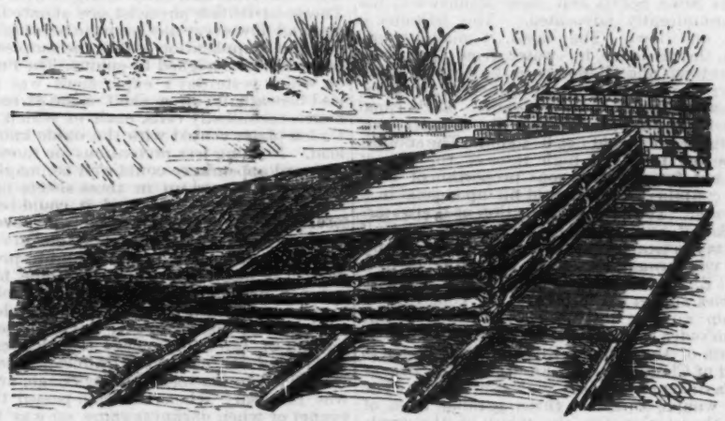
The construction of this dam is shown very thoroughly in the cut. Its qualities of firmness, compactness and durability adapt it to any sort of bottom, whether it be sand, soft mud, gravel or rock. The first step in the process of building it is to lay the foundation logs R A which extend across the stream (being spliced if necessary), to obtain the requisite length. They should be imbedded in ditches crossing the stream transversely, and of sufficient depth to bring the upper surface of the logs nearly on a level with the bed of the stream. One of the logs is laid at the foot of the apron, another at the point where the dam is to be raised, and the third, fourth and fifth farther up-stream, as shown in the cut, the distances between them being six or eight feet. The ends of these logs should project some distance from the sides of the dam into the bank or under the abutment. The weight of the abutment resting upon them will have the effect to hold the dam in its place and prevent it from being lifted or moved forward by the force of the current.

The second series of logs B B are laid across the first course, lengthwise of the stream, and about six feet apart, the butt ends resting upon the lower log of the first course. The dam is then raised at the second log of the foundation, which is six or eight feet from the front log, the intervening space being occupied by the apron of the dam. A log of considerable size is laid down directly above the foundation log, and notched to the logs B B wherever they cross. A smaller log may be laid in like manner above the third foundation log, and also at the fourth if desired; as these cross-logs or binders, which should be put in with considerable regularity, especially at the face of the dam and near it (as shown at D D) will serve to support and hold together the whole fabric. The alternate courses of logs having been carried up to the height of about five feet at the face of the dam (which should be nearly perpendicular) and sloping back gradually as shown in the cut, the crossing of the logs will form cribs or chambers, as at C, which are to be filled with stone or gravel. Stone is to be preferred if conveniently at hand, but gravel answers the purpose nearly as well. The binders on the top of the dam, crossing the stream, are to be firmly fastened to the logs upon which they rest—those at the crest of the dam and at the lower edge of the planking being secured by bolts, which pass through all the successive logs below them to the very foundation of the dam. Except at these points it will be sufficient to fasten the binders with long pins to the logs beneath them. The planking E already referred to extends from the crest of the dam about twelve feet toward the up-stream end, and serves to protect the front of the structure from damage by ice or drift-wood. The spaces at H, at the rear of the dam, below the planking, should be filled with stone or gravel.

The abutments F (only one of which is here shown, as our engraving comprises but half of the dam, giving a front, top, and sectional view) are built, as already stated, upon the ends of the foundation logs projecting from the sides of the dam, aiding thereby to hold the structure in its place. The abutment represented in the cut is of solid masonry, good building stone being the material employed; but it may be more cheaply constructed, either of rough stone or crib-work, as described in the introduction of this chapter.

The apron of this dam should be planked between the projecting logs, as shown at G, the planks extending back under the first transverse log, which begins at the face of the dam.

It will be manifest from the nature of its construction that no part of this dam can be moved from its place without the entire fabric going with it. The different portions being firmly connected and secured to each other, the structure must go out bodily or not at all. The great breadth of the dam at its base is one of its strongest advantages, preventing it from being undermined by the current—a danger which constantly threatens a dam with a narrow foundation, let it be ever so strongly built. It is also to be observed that the amount of timber required in building by this plan is very moderate, being much less than is often used in dams which do not possess nearly so much actual strength as is here afforded. As a practical example of the reliable character of this dam, we may here remark that one of the publishers of this work, having had two costly dams of cut stone carried away from the same site by high water, finally built one according to the plan here described, at a total cost of $700, and found it perfectly safe, the floods of four successive years, some of them extremely violent, having failed to carry away any part of it, or inflict any material damage. Neither of the two stone dams which preceded it stood over eighteen months, the bottom being of the sandy and treacherous nature to which a great part of the difficulty involved in the science of dam building is to be attributed.



A Safe and Economical Dam.

* From Leffel's "Construction of Mill-Dams" and Bookwalter's "Millwright and Mechanic."

THE GULF STREAM AND CLIMATE.

Dr. S. Haughton has pointed out some of the effects of the Gulf Stream and its counter current, the Labrador Current, upon climate. The northern hemisphere was warmer than the southern from latitude 0° to latitude 30°, and it was colder than the southern latitude from 40° to 60°. The higher temperature of the southern hemisphere in the temperate latitudes was explained by the existence of three gulf streams in that hemisphere, while there was only one in the North Atlantic, and a partial one through Behring's Straits in the northern hemisphere. The general climatic effect of the Gulf Stream was therefore to make the annual range of temperature less, but it had no effect whatever upon the summer heat, or upon the fruiting of plants, and trees that required a given July temperature for reproduction. The January temperatures in the North Atlantic at 70° were raised by the Gulf Stream, while the July temperatures remained unaffected. The effect of the cold currents, which were indirectly caused by the warm currents, to preserve the proper condition of equilibrium, was nothing at all upon the January temperatures, but they lowered the July temperatures. The effect of the cold water was to lower the July temperature and to leave the January untouched, and the effect of the warm current from the south was to raise January and to leave July unaltered.

REASONS FOR A RESIGNATION.

Chicago, Ill., October 20.—Charles S. Waller, Superintendent of the Water Department, resigned yesterday because of what he believed to be the interference of the Mayor with his functions, and J. K. Tenney followed up the resignation of his Chief with the following caustic letter:

"To the Hon. Carter H. Harrison, Mayor of Chicago:

"Believing that a wave of rascality and peculation is about to submerge your administration, I decline risking a good character in such company as you appear to favor at present, and hereby tender my resignation as Registrar of the Water Department, and wish to be relieved as soon as possible. Yours, &c., J. K. Tenney."

The Chicago *Evening Journal* says: "It is to be regretted that Mr. Waller resigned from the management of the Department of Public Works, which he conducted on business principles, and with an eye single to the public welfare. The Mayor will find it difficult to get as good a man for the place."

Mayor Harrison praised Mr. Waller's honesty of purpose, and gave him credit for having been quite useful to the city, especially in the way of economizing. Mr. Waller was, he thought, lacking in faith in humanity, and there were but a very, very few honest men, especially officials, and he worried himself unnecessarily about what his subordinates would do. He also took too much upon himself, and for a man of his physique was too confined to his desk. Mr. Waller was a good man, and he regretted his leaving.

THE CITY OF ROME.

The Inman Company's new steamer the City of Rome arrived in this port on the 25th ult. This latest addition to the trans-Atlantic fleet is commanded by Captain Kennedy. She has ten engineers, two drivers, ten officers, and two hundred men. Except the Great Eastern she is the largest passenger ship ever built. Her dimensions are as follows: Length of keel, 546 feet; length over all, 590 feet; breadth of beam, 52 feet; depth of hold, 38 feet 9 inches, and depth from top of deck-house to keel, 52 feet. Her tonnage is 8,300, being over four-fifths that of the Great Eastern. The engines are "inverted tandem" engines, each of the three having a high and low-pressure cylinder. They are set on an angle of 120 degrees to each other on the shaft. The high-pressure cylinders are 43 inches in diameter and the low-pressure ones 86 inches, the stroke being 6 feet. The enormous screw which is driven by them is 24 feet in diameter. The steam is furnished by eight cylindrical boilers, each 14 feet in diameter and 19 feet long, built to stand a pressure of 90 pounds to the square inch. The boilers are heated by forty-eight furnaces. The crank shaft weighs 64 tons, and was built by Sir Joseph Whitelock of his fluid compressed steel. The propeller shaft is 25 inches in diameter and 30½ feet long, weighing 18 tons. The bed-plate for the engines weighs 100 tons. In the construction of the hull the greatest possible strength was sought. The vessel has two complete decks above, running from stem to stern, while the lower deck stops half-way. A large number of water-tight compartments have been constructed, the longest being only 60 feet. The boilers are in two of these compartments, so that one might be flooded and the vessel remain under control. The vessel is provided with four masts, the one aft being jigger-rigged to aid in managing the vessel.

The interior fittings are magnificent. The designs are by Wallis & Flockhart, of Bond street, London. The dining-room, a hall 80 feet long and 52 feet broad, has long lines of light iron pillars supporting

the upper deck and cased in carved English oak. There are 260 revolving chairs handsomely upholstered in blue velvet, numbered to correspond with the berths. Around the saloon is a dado paneled in oak and walnut. There are satin-wood margins, rich flutings and groins, with arches leading to the molded ceiling, whose ivory white and rich gilt harmonize well with the rest of the saloon. There are two elegant saloons for ladies, one on the upper and one on the main deck, and also two for gentlemen. The City of Rome has accomodations for 270 saloon passengers and 1,200 in the steerage. The arrangements for immigrants are very fine, separation of sexes and the greatest possible comfort having been aimed at.

THE DANGERS OF ELECTRIC LIGHTING.

The danger of fire arising from imperfect insulation of the conductors of electric lamps has received several illustrations recently in this city and Philadelphia which should not be neglected by the companies concerned. The disaster that was but narrowly escaped at the Germania Theatre recently, and the recent fire in Philadelphia, probably from the same cause, and certainly from defect in the electrical arrangements for lighting the building in which it originated, are but typical examples of what may be expected when the electric lamp comes into more general use, unless a more perfect and more durable mode of insulation is adopted than that of merely winding the wires with thread or cord, or sheathing them in vestments woven of the same perishable materials—liable to become rotten in a short time through the action of the elements, or to be worn away by sharp friction in a few hours. The sources of peril are two. First, the insulation may be worn away, and the conductor, coming in contact with wood-work, almost instantaneously ignite it; or, secondly, by reason of overlooked defect at any particular point, heating to the degree of fusion may occur, and the timber be ignited by the spontaneous formation of a transitory voltaic arc. The remedy for the first would appear to be the use of a more substantial insulating material, which would perhaps somewhat increase the first cost of the plant, and would compensate for the increase in the long run by correcting a source of waste that is now very considerable. This would enable electrical engineers to run the wires under ground from the central station to each of the several lamps of the system; or, if employed in house lighting, they should be carefully boxed, not exposed to abrasion from any accidental cause. With the voltaic arc (or carbon) lamp there is another and very powerful reason why the conductors should be secured from possible contact with the hands of children or careless adults. Partly, perhaps, on the score of economy, but in the main because high intensity has been found the surest means of insuring steadiness, the various systems of electric lighting in which the arc is employed rely upon intensity and electromotive force rather than upon actual volume of electricity. There is doubtless power enough in any pair of conductors employed in lighting Broadway at the present juncture to destroy life by instantaneous shock, were the wires to be placed in the hands of a person sufficiently venturesome to try the experiment. The insulation furnishes some protection against accidents of this kind from careless handling, but very severe shocks may be experienced even where it is unbroken by pressing the conductors lightly with the fingers. But granting that more perfect insulation and the burial of the wires would obviate the most evident sources of danger, the question to be solved by electrical engineers, before proceeding further, is whether volume cannot be advantageously substituted for intensity in systems of lighting based upon the arc principle.—*N. Y. Times.*

A COMPRESSED AIR MOTOR ON THE ELEVATED R. R.

It is only just now, after the elevated roads have been in operation for about three years, that the officials are apparently putting forth experimental efforts to supply a motor on the roads which will be less of a nuisance than the present style of locomotive in use by the Manhattan Company. Last Sunday, for the first time, cars were drawn over the tracks by other than a puffing, snorting, ill-smelling, dusty, noisy and uncouth-looking contrivance. On that day a train of four cars, carrying between fifty and sixty people, was run over the Second avenue railroad by means of a compressed air motor. The trial trip was made from One Hundred and Twenty-seventh street to Forty-second street and return, and it took the motor nineteen minutes to make the down trip, including the usual stops at intervening stations, and fifteen minutes to return, the present regular running time for that distance being twenty minutes each way. The motor used in the experiment contains four tanks, in which compressed air is stored, and which sustain a pressure of 600 pounds to the square inch. It started on its journey with a pressure of 580 pounds to the inch, and when the experiment was over had a surplus of 125 pounds of force. The claim of the inventor is that, with proper facilities at each end of the road, the motor can be completely charged in from two to three minutes' time, and it is further asserted that by its use all the now existing objectionable features of the dirty smoke, the coal gas, and the puffing noise will be obviated, without any decrease in the speed of the trains. All who travel on the elevated road, especially those known as the "New York" lines on the Third and Ninth avenues, and who have been subjected to the constant annoyance of the snort of the smoke-pipe, the offensive odor of gas, and had their eyes and clothing injured by the flying cinders, can readily appreciate the very great increase of comfort that would ensue if these things were abolished. The experiment in question appears to have demonstrated that it is possible to do away with these drawbacks to comfortable rapid transit in the city, and it will, therefore, be interesting to watch what action the railroad officials will adopt toward utilizing the means thus placed in their power of materially increasing the comfort of the public.—*N. Y. Times.*

A SHIP RAILWAY FOR CHIGNECTO.

For three-quarters of a century the project of a canal through the Isthmus of Chignecto which connects Nova Scotia and New Brunswick, has been prominently advocated. The isthmus is narrow and low. The canal, if made, would shorten the distance by water from Quebec or Charlottetown and all points in the Gulf or River St. Lawrence to St. John by hundreds of miles. Two great obstacles, however, exist. For a canal with locks fresh water to feed the summit level for a large traffic could not be found. The summit could be fed from the high tides of the Bay of Fundy but for the enormous proportion of sediment it contains, which would fill up a canal in a few weeks. The unequal elevation of the waters of the Bay of Fundy and the waters of the Gulf render impracticable the forming of an ordinary channel cut through on a level. Mr. H. G. C. Ketchum, C.E., of Fredericton, N. B., in a letter to Sir Charles Tupper has proposed the construction of a ship railway instead of the canal. Mr. Ketchum's idea is to construct a railway from near the mouth of the Tidnish River in Baie Verte to the head of Chignecto Bay, an arm of the Bay of Fundy, a distance of some eighteen miles. The railway would consist of three parallel lines of track of the usual gauge, the width of the triple track being about thirty-six feet, and the rails of special make and size. Mr. Ketchum believes that propellers of 1,200 tons, which with their cargoes would weigh 2,000 tons, could be safely transported in this way, and that the ship railway would cost but a small proportion of the cost of a ship canal.

HOUSE-DRAINING VENTILATION.

A practical system of ventilation and house-draining has been put into operation at the Sherman House, Chicago, under the supervision of Inspector Genung, of the Health Department. It proves conclusively that there is a means of relief from the nuisance of foul odors escaping from catch-basins and drains. Three large catch-basins in the northeastern corner of the basement of the building receive all the liquid waste of the kitchens of that great hotel. These have been connected by pipes ranging from six to ten inches in diameter with flues adjoining the smoke-stack. The current upward in these flues is strong enough to extinguish a lighted torch, and a piece of paper may be held on orifices in the ventilating pipes by the suction until the paper is actually eaten through by the action of the currents. Water-closets have been ventilated by pipes which also extend to the smoke-stack flues, and so successfully that there is not an indication of foul odor in nor about them. The force of the current in these ventilating pipes is appreciated when it is known that from 73 to 400 cubic feet of air pass through them in a minute. The basement of the building has been entirely relieved of foul odors. It is proposed to test further the efficacy of this ventilation by removing one or more traps from the soil-pipes beneath the water-closets, to show that the current of air will be downward rather than upward, as is usually the case. Thus that abominable cesspool, the trap, will be no longer retaining filth to generate and give off poisonous gases. The contents of the closets will go immediately to the sewer and the odors will escape into the air above the house, through the ventilating flues. If the system of ventilating the drains is extended throughout the entire building there can hardly be any such thing as sewer-gas in it.—*Chicago Times.*

[For hotels or establishments where the fires are kept up, this system will show good results, but in private houses or offices, without a constant controlling upward current, such as is furnished by a hot air flue, it would be liable to reflex currents, which would destroy its usefulness.—ED. ENG. NEWS.]

THE ELECTRIC LIGHT IN A PULLMAN CAR.

Yesterday the electric light fairly conquered a new domain. The Brighton Railway Company, which of late years has been a pioneer of improvements on the iron road, ran a special train from Victoria to Brighton and back, with a saloon carriage lighted by stored electricity. The event, noteworthy in itself, may come to possess a historical interest, since there is no doubt that it was the first time, either in the Old World or the New, that accumulated electrical energy had been so employed; while the complete success which attended the experiment must unquestionably mark a new departure in railway management. It was only a few months since M. Faure sent to Sir William Thomson his little box of lead plates coated with red oxide and fully charged with electricity. The great British physicist saw at once its capabilities, and now every day seems to be bringing to light some new application of this, the simplest of all apparatus ever designed by genius. The Pullman car, on which yesterday's experiment was made, carried beneath it on a shelf some 32 small metal boxes, technically cells, each of which contained leaden plates coated with the oxide known as red lead. Nothing less pretentious or more inert in outward appearance could well be imagined. Yet there was stored up in those sheets of lead an amount of force which, if it could be suddenly liberated, would v stly exceed the power of any storm of tropical lightning. A steam-engine had been at work on the previous night, producing a current of electricity which, in some mysterious manner, had hid itself away in the folds of the metal and beneath the cloak of red oxide, but was ready at any instant to give back in the form of light or of force the energy that had created it. Twelve of Mr. Swan's little incandescent lamps were fixed to the roof of the carriage, and all that was necessary when the train passed through a tunnel or when darkness came on was to turn a switch, and instantaneously a mild, steady, and brilliant light filled the saloon. From the point of view of the traveler, the experiment was completely successful; a superior illumination could hardly be desired; and if it be true, as possibly sanguine electricians assert, that this storage can be effected at a smaller cost than oil, the pleasant trip to Brighton yesterday afternoon may have wide-reaching effects.—*London Telegraph, Oct.* 15.

UNDERGROUND TELEGRAPH WIRES.

The system adopted by the German government of laying telegraph wires underground has, it appears, recently been completed, at an expense of abont seven millions of dollars. This subterra ean cable connects 221 towns with a net-work of wire, and removes from the streets all the poles and other contrivances which formerly defaced them. About the time that this commendable enterprise is finished in Germany a similar undertaking has been begun in America, where the need for some system of building the telegraphic circuit so that the wires will not be a blemish and an eye-sore has long been a crying one. The work of laying subterranean conduits in Philadelphia was begun a little while ago, and is now under good headway, the work progressing at the rate of half a block per night. The system comprises an arrangement of conduits which have twenty chambers, each chamber having a capacity for accommodating fifty wires. One thousand wires are thus safely inclosed in a conduit, and they can be reached and connections made by means of manholes, which are constructed in every block. It is gratifying to note, even at a late day, this evidence of long-needed progress in the matter of improvement in the telegraphic system, but the question

is how much longer must this city, which suffers most keenly from the unsightly presence of a countless mass of telegraphic and telephone wires, which litter and deface some of its prominent and handsomest thoroughfares, wait before steps are taken to relieve it from a constantly growing nuisance. Every heavy storm of the winter and every large fire brings to the telegraph companies a costly reminder, in the breaking of the wires, of the need of some other method of laying wires, and certainly there has been no lack of public complaint to convince them that the present primitive and faulty system of stretching wires on poles is extremely unpopular. If the German government finds that over two hundred towns can be covered with underground telegraph at a total cost of $7,000,000, surely the cost of supplying the metropolis with the same advantageous system will not reach so large an amount as to render it impracticable, which seems to have been the excuse for inaction before the new system was introduced in a neighboring city.—*N. Y. Times.*

THE USE OF ELECTRIC LIGHTS.

The origin of several recent fires in this city and elsewhere being attributed to the use of electric light, the Board of Underwriters has been anxiously seeking a plan whereby the insurance interests would be in some degree protected against the new element of fire hazard. Several days ago the matter was referred to a committee consisting of W. A. Anderson, G. W. Montgomery, L. Remsen Lane, William H. Ross, A. H. Walton, J. H. Langford and John M. Whiton. This committee made a report, upon which the board has adopted a standard for electric light wires, lamps, etc., subject to future conditions. The standard is divided into five conditions, and is substantially as follows:

First. Wires to have 50 per cent. excess of conductivity above the amount calculated as necessary for the number of lights to be supplied by the wire.

Second. Wires to be thoroughly insulated and doubly coated with some approved material.

Third. All wires to be securely fastened by some approved non-conducting fastening, and to be placed at least 2½ inches for incandescent lights and 8 inches for arc lights from each other, and 8 inches from all other wires and from all metal or other conducting substance, and to be placed in a manner to be thoroughly and easily inspected by surveyors. When it becomes necessary to carry wires through partitions and floors they must be secured against contact with metal or other conducting substance in a manner approved by the board.

Fourth—All arc lights must be protected by glass globes inclosed at the bottom to effectually prevent sparks or particles of the carbons from falling from the lamps, and in show windows, mills and other places where there are materials of an inflammable nature chimneys with spark arresters shall be placed at the top of the globe. Open lights are positively prohibited. The conducting frame-work of chandeliers must be insulated and covered the same as wires.

Fifth—Where electricity is conducted into a building (from sources other than the building in which it is used) a shut-off must be placed at the point of entrance to such building, and the supply turned off when the lights are not in use.

Application for permission to use electric lights must be accompanied with a statement of the number and kind of lamps to be used, the estimate of some known electrician of the quantity of electricity required, and a sample of the wire (at least 3 ft. in length) to be used, with, in addition, an electrician's certificate of the carrying capacity of the wire. It must also be stated in applications where the electricity is to be generated, whether the connection will have metallic or ground circuit, and, as far as possible, give full details of the manner in which it is proposed to equip the building. The board desires all applications for the permission referred to sent to William M. Randell, Secretary of the Committee on Police and Origin of Fires.

LOCOMOTIVE ENGINEERS.

The annual session of the International Brotherhood of Locomotive Engineers assembled at Baltimore, Oct. 19. There was a full attendance of delegates from the United States and Canada. P. M. Arthur, Grand Chief Engineer, of Cleveland, presided.

Acting Mayor Veazey, in the absence of Mayor Latrobe, delivered an address of welcome.

Grand Chief Engineer Arthur, in his annual address, stated that thirteen sub-divisions had been formed since last meeting. Number of members, 2,654. Thirty-four claims paid $17,814; total since organization, $1,178,888.

Arthur took strong ground against the law of some States in regard to color blindness, claiming that railway companies were abundantly able to judge of the qualifications of their employés.

He also objected to engineers being compelled to pay for breakage, except maliciously done.

THE LIGHT-HOUSE ESTABLISHMENT.

ANNUAL REPORT ON ITS CONDITION AND NEEDS—EXTENDING THE SERVICE.

WASHINGTON, Oct. 27.—The annual report of the Light-house Board has been submitted to the Secretary of the Treasury. The number of light-houses is 700; light-ships, 29; fog signals operated by steam or hot air, 59; lights established on the Western rivers, 864; automatic whistling buoys in position, 27; bell buoys in position, 11; other buoys, 3,284. The work of rebuilding Cape Henry Light-house was much delayed by the inability of the contractors to fulfill their contract for the iron-work, but it is hoped that the new light will be displayed before the end of the current year.

The board again calls attention to the necessity for constructing two or three first-order light stations on the Pacific coast, notably at Pointsur, south of the Harbor of San Francisco, and one on Northwest Seal Rock, off Point St. George, to the northward. On the great lakes three coast lights are needed, one at Braddock's Point, Lake Ontario, which will cost $35,000; one on the west shore of Lake Huron, between Fort Gratiot and Sand Beach Harbor, which will cost $35,000, and one on Round Island, Straits of Mackinac, which will cost $20,000. Many lesser or harbor lights will become necessary with the extension of commerce. The amounts appropriated annually for repairs of light stations have not been commensurate with the needs of the establishment. Many structures are in a dilapidated condition, and must soon be rebuilt. The amount estimated as needed to enable the board to make the repairs deemed necessary during the present fiscal year was $400,000; but as only $310,000 was appropriated, and as $35,000 of that amount is necessary for the rebuilding of Sharp's Island Light Station, Chesapeake Bay, which was destroyed by fire last winter, only $275,000 remains with which to do the work required to make good the damages of an unusually tempestuous season. It is therefore earnestly recommended that $400,000 be appropriated for repairs during the coming year. The fog signal service is in a most efficient condition, but as with all machinery there is a necessity for constant repairs and renewals, and as the number of signals operated by steam yearly grows larger, the sum of $60,000 is asked for their maintenance and for the establishment of such new ones as the demands of commerce may exact.

The advance made in the appliances for generating electricity and the great improvements in the efficiency of the burners used in electric lamps justify the board in recommending the introduction of electricity in some of the first-order seacoast lights. An appropriation of $50,000 is asked for this purpose. For salaries of light-keepers the estimate is $609,000, an increase of $24,000 over that for last year. This is owing to the additional number of keepers required by the erection of new light-houses. There are in actual employment and required for new lights already appropriated for 1,015 light-keepers. The average pay authorized by law is $600 per annum for each keeper. For supplies of light-houses the estimate is $375,000, the same that was asked for last year. Although the number of light-houses is constantly increasing, the board has been able to furnish them with annual supplies during the past year for the same amount as was appropriated for that purpose seven years ago. This has mostly been accomplished by the introduction of mineral oil into a large proportion of the light-houses.

For the expenses of light-ships the estimate is $250,000; the same was asked for last year. This amount, it is thought, will be sufficient, although the number of light-ships on stations will be increased by two, one on the northeast end of Five-fathom Bank, coast of New Jersey, and one to mark Trinity Shoal, coast of Louisiana. For expenses of buoyage the estimate is $325,000, the same that was asked for last year. For inspecting lights the estimate is $4,000, required to pay the expenses of inspection and rewards for information as to collisions. The total amounts which it is estimated will be needed for the general service of the light-house establishment during the coming fiscal year are as follows: For the light-house establishment, $2,248,000; for light-houses and fog signals, $530,000.

COLORADO MINING LAW.

A grizzled old bunch of antiquity recently struck a lead near Gunnison, Col., and left the following notice written on an old envelope and stuck in a split stick:

"TAK NOTIS!

"The undersined clams this lede with all its diffs, spurs, angels, sinosities, etc., etc., from this staik a 100 fete in each direcshun, the Same being A silver baring load, and warning is hereby given to Awl persens to kepe away at their peril. Any persons found trespasing on this Clame will be persecuted to the full extent of the law. This is no munky talk, butt I will assert my rites at the point Of the sicks shuter if legaly Necessary so taik head and good warning, Accordin to law I post This Notiss. JOHN SEARLE."

—*Gunnison Times.*

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

Richmond, Ind., by a large majority, voted on the 31st ult., against building water-works. The manufacturers and laborers voted against it, and the tradesmen and politicians for it.

The artesian well near the Providence station at Boston is now 2,240 feet deep, with a capacity of over 150,000 gallons a day. The water is strongly impregnated with sulphur. The well will be bored several hundred feet deeper.

Advices from Oshkosh say that water from Lake Winnebago is rising constantly, and that the damage to business is estimated at $5,000 per day. Oshkosh demands of Neenah that the water be let out of the lake through dams there, but if that is done the city of Appleton will be drowned out. Great excitement prevails in that locality because of Oshkosh's demand of relief from Neenah, and Appleton's threat against Neenah if the water is let out there.

Artesian wells are beginning to command the attention of the people of Boston and New York. They have been tried in the latter city with doubtful results. Most of the brewers have sunk them, but many of them have been failures. Though sixteen wells have been sunk under the Western Union telegraph building, Croton is still depended upon. Were the land about Manhattan Island higher, artesian wells might be as great a success as they have been in other parts of the world. The famous well of Grenelle, near Paris, 1,793 feet deep, yields 21,000 gallons per hour. The Passy well, 1,923 feet deep; gives forth the enormous quantity of 62,000 gallons per hour. Those sunk by the French in the Sahara desert are a success. If the well which is being sunk in Providence Street, Boston, at a great expense, should prove as productive as these, the water problem there will be speedily solved.—*Rochester Democrat.*

ALBANY'S WATER SUPPLY.—The threatened water famine in New York, which the recent rains have not wholly averted, shows that the supply service for that city, notwithstanding millions of money have been spent thereon, is not fully adequate to meet all demands upon it. In this city, however, thanks to our admirable water-works and the forethought of the Commissioners, no danger of a famine in this respect need be apprehended. Supt. Carpenter, who, by the way, has just returned to duty after a six weeks' illness, said this morning that Albany was far in advance of other cities as regarded its water supply, as it was, in fact, inexhaustible. By the admirable service perfected, water to an amount sufficient for manufactories, fire purposes and consumption of hotels and families is secured from the river, and when this is roily or cannot be used from other causes, the resources of the Rensselaer and Tivoli lakes are drawn upon to meet the demand. The entire service is in excellent order and working most admirably.—*Evening Journal, 2d.*

ELECTRICITY.

A signal station in communication with the United States Meteorological Bureau is to be established on the volcano of Kilauean.

THE LAWS OF ELECTRIC LIGHTS.—Most people who read of volts, webers, and ohms in the discussion of electrical systems are not aware that the two former represent units of very different properties in the current, and that the one means shock by contact and danger to the wires by heating, that cannot be wholly done away with by any measures of precaution, while the other represents safety from those factors. Can the carbon lamp be economically operated with currents of low intensity and large volume? Or are the dangers arising from high intensity inseparable from the arc mode of producing light? If the latter is the case, the carbon lamp finds the limit of its utility in the lighting of large open spaces, and its application to in-door purposes, and particularly to domestic use, is out of the question. Equally cautious should steamship companies

be in placing it in the cabins of their vessels, whatever may be its economy, and in manufactories and dry goods stores there is an element of peril in its use that ought not to be incurred. Perfect insulation cannot obviate the danger from fusion by overheating; indeed, the more perfect the insulation the greater the peril. Experiments with the incandescent principle have shown that volume may be substituted for intensity in systems of electric lighting based upon it. When such a system, capable of lighting a large building, is in full operation, and the lamps are all blazing with the highest brilliancy, one may disconnect the poles of a lamp and handle them without other shock than a faint tingling of the tips of the fingers between which they are grasped. There is thus no danger whatever from heating, and none therefore from imperfect insulation, the waste of electricity being the only factor that requires to be considered. There seems to be no inherent reason why systems of arc lighting should demand an intensity not in the least essential to incandescent systems, and discarded alike by Swan and Edison as both dangerous and useless. There are able electrical engineers now engaged in mastering the laws of the carbon light, and this, it would seem, is one of the most important questions they have to solve, if they would not have its hard-won popularity suddenly extinguished by a thrilling disaster in theatre, manufactory, dry-goods store, or possibly on board ship in mid-ocean.

BRIDGES.

The last of the seven massive piers of the Albany & Greenbush bridge has been brought to completion. On June 1, 1881, the first pile was driven, and after a lapse of hardly five months the finishing pier is in position. It is anticipated that the bridge will be open for traffic by March. Its total length, including the approaches, is about 1,669 feet, or nearly one-third of a mile; width from center to center of trusses, 28 feet; it is 29 feet above low-water mark, and the railroad tracks will be about 18 feet above the wagonway. The draw is 400 feet long, and the heaviest swing ever used. Its weight is 1,500 tons, and a 30 horse-power engine will be required to operate it. The bridge will cost $650,000, and it will be used by the New York, West Shore & Buffalo Railroad.

The corner-stone of the new bridge over the Ohio, between Louisville, Ky., and New Albany, Ind., was laid with masonic ceremonies Saturday, in the presence of an immense assemblage. It is intended to be the most elegant and finished bridge on the Ohio River. The length will be 4,800 feet, including the approaches, and forty-three feet wide on the roadway deck. The spans will be the largest used in any truss bridge in the country. It will be constructed, besides the masonry, of wrought iron and steel, and the wood will be subjected to the preservative process. The roadways will be of asphalt and gravel, the spans 583 feet long, the piers 111 feet high. It will include a railroad track for the Kentucky & Indiana Railway, a double track for street-cars and footways. The cost will be $1,500,000.

The contract was executed on the 31st ult. for the bridging, for the Erlanger syndicate, of an immense trestle across Lake Pontchartrain. The Alabama & Great Southern Railroad ends at Meridian, where the New Orleans & Northwestern road begins, leading to Lake Pontchartrain. Opposite the terminus of the New Orleans & Northeastern road, at Lake Pontchartrain, is the northern terminus of what is known as the "Old Fork Road," which begins at Canal street, New Orleans The last-named road has been used principally for carrying pleasure-seekers from New Orleans to Lake Pontchartrain. It has recently been purchased by the Erlanger syndicate, and, in order to connect this road with the New Orleans & Northeastern, the construction of a trestle across the lake is found necessary, which will form, when completed, a direct connection with Meridian. The trestle will be six miles long. This link will form an important connection and greatly develop the strength of the entire Erlanger system. The contract for the erection of a creosote factory near the lake will be awarded in a few days. This establishment will be built for the purpose of supplying enough creosote to be used for saturating those portions of the timbers under water to prevent them from decaying.

RAILROADS.

Forty-four locomotives were finished at the Paterson works during September, and 40 during October. The shops have never before had so many orders on hand.

W. H. Barnes, of West Stockbridge, has begun the survey of the proposed new road from Pittsfield by way of Coltsville to Dalton.

HALIFAX, Oct. 27.—A project is on foot to form a joint stock company in Lahave, Lunenberg County, to build a marine railway. The proposed capital is $10,000 in $50 shares.

It is authentically reported that Jay Gould has been secretly surveying a line from Irondale, on the Iron Mountain Railroad, to the southwest, intersecting the proposed Kansas City & Memphis Railroad and the projected Fort Scott & Gulf Line.

An execution was issued against the Allentown Rolling Mill Company, Oct. 31, for $1,348,586. The plaintiff is Ario Pardee, of the firm of Ario Pardee and J. Gillingham Fell. These proceedings may cause the works to change ownership.

CITY OF MEXICO, Oct. 26.—The Government has ordered the commencement of the payment of the subvention to the Central Railroad. It has decided that the Mexican National Railroad Company cannot build to Guadalajara.

The annual statement of the Pullman Palace Car Company for the year ending July 31, 1881, shows that after paying all expenses, including rental of leased lines, interest on bonds, amounting to $191,867, and dividends on capital stock, amounting to $482,166, the company had a cash surplus for the year of $981,053.

The Columbus & Council Bluffs Railway Company is the newest venture. The principal office is to be at Oskaloosa, and the capital provided for by the articles, which are now on file with the Secretary of State, is $20,000,000. The incorporators are Liston McMillan, David Morgan, Wm. Loughridge, B. F. McMillan and Cary Cooper.

The Holly Water-works company has brought suit against the Omaha Water Company for alleged infringement of patent. As this involves the broad claim of the Holly Company that all direct pressure systems are covered by the Holly patents, the outcome of the suit will be awaited with interest by all cities that contemplate water-works.

The Atlantic & Northwestern Railroad, which, it is said, has just effected the purchase of a controlling interest in the Prescott & Ottawa Railroad, running from Prescott to Ottawa, is controlled by the Canadian Pacific Syndicate, which already controls the line from Ottawa to Brockville, and thus secures all transportation lines from Ottawa to the lakes. The syndicate has just closed a contract for the winter delivery of 65,000 tons of steel rails from England and Germany. This is said to be the largest order ever given from this continent.

The Baltimore & Ohio Railroad Company have several lines under construction: Baltimore to Philadelphia, C. P. Manning, Baltimore, and Samuel Canby, Wilmington, Del., Assist. Engineers, each in charge of one-half this line; B. & O. Short Line, Cornellsville to Washington, Pa., W. A. Pratt, Resident Engineer, B. F. Randolph, Assist. Engineer-in-Charge; Valley Railroad, Staunton to Lexington, Va., A. G. Warfield, Assist. Engineer-in-Charge. Jas. L. Randolph, C.E., is Chief Engineer of the B. & O. R.R. and all its divisions.

It is learned that the Cole combination is working continually to complete its branches as soon as possible. The line from Rome to Macon, Ga., is now rapidly nearing completion, and steel rail is being laid its entire length. The fact that the Cole system means business is readily realized when it is learned that over 5,000 men are now employed in constructing the various branches. By the 1st of June there will be one line open from Atlanta to Brunswick, on the Atlantic coast, and another seaport will be opened to the grand system of railways.—*New Orleans Times.*

A surveying party organized by Geo. McPhillips, D. L. S., left Winnipeg last week for the purpose of surveying the first fifty miles of the Souris & Rocky Mountain. This road is to extend from the line of the Canadian Pacific, at the crossing of the boundary of the Province, to a point on the Little Old Saskatchewan, about two or three miles from Rapid City, and thence by way of Shoal Lake to Fort Ellice. It is intended to push the work rapidly forward, and the expectation of the Company is to have the first fifty miles finished by October, 1882. The time occupied in the surveying of the first fifty miles will be about a month.

The San Francisco & North Pacific Railroad Company, commonly known as the Donahue line, have had a party out surveying the Russian River Gap with a view of extending the road from Cloverdale to Ukiah and eventually up to the Oregon line. The gap along the Russian river extends a distance of 12 miles, and has proved exceedingly difficult to survey. It is stated that it will be an expensive piece of work to run a line through it. Throughout the entire distance it is a succession of steep, precipitous rocks, which will have to be blasted out. Some tunnels will be run, one of them 1,600 feet in length. It will cost, it is estimated, $50,000 a mile for the 12 miles through the gap.

On the California Central Railroad, now in course of construction, work on all the sections is being energetically pushed forward. Colonel Lyman Bridges, Engineer-in-Chief, states that he has ten corps of engineers in the field, one on the San Francisco & Ocean Shore road between this city and Santa Cruz, and nine on the main line at various points between Santa Cruz and the other side of the Sierra into Nevada and Utah. There are from 15 to 20 men in each party, all under the direction of experienced engineers. The corps are fully equipped and are, as stated by Colonel Bridges, locating what will prove one of the best paying lines across the continent of America.—*San Francisco Evening Bulletin.*

The organization of the New York & Connecticut Air Line Railway Company was completed on the 28th ult. by the selection of officers for the New York end as follows: President, Sheldon Collins; Vice President, H. C. Hepburn; Treasurer, C. V. Sidell; Secretary, Thos. N. Browne; Directors, J. D. Mowry, Norwalk; B. A. Sands, F. W. Ford Sheldon Collins, H. Walter Webb, William F. Black, Thomas N. Browne, C. V. Sidell, David Lydig, H. C. Hepburn, G. L. Clark, Providence, R. I. All of the above named gentlemen except Mr. Mowry and Mr. Clark are of New York. As the law requires separate officers for Connecticut the following have been chosen for that end of the line: President, Samuel A. Olmstead, of Norwalk; Vice-President, Sheldon Collins; Treasurer, C. V. Sidell; Secretary, Thomas N. Browne; Directors, P. T. Barnum, Bridgeport; Samuel E. Olmstead, ex Gov. Miner, of Connecticut, Charles D. Ingersoll, Henry C. Hepburn, C. V. Sidell, Sheldon Collins, H. Walter Webb, of New York, W. M. Douglass, of Providence, and George R. Cowles, of Norwalk. One of the directors said: "We propose to build a new road on a direct line from New York to New Haven not far from the present line of the New York & New Haven road, but further from the shore and straighter, so that we shall go directly through the main places rather than some distance away from them, as the present road does at Norwalk, Westport and other points. Our line will run forty-five miles in Connecticut and seventeen miles in New York. It will be fourteen miles shorter than the present line by reason of being laid out so as to avoid the sharp turns and out-of-the-way curves that make the present line of the New York & New Haven road a marvel to engineers. Our capital is $6,000,000, and we are capitalized at one-third less than any other road running in that direction. The general idea of the present enterprise was originated in 1871, but capitalists have been wary of competition with the great corporation now controlling the business. This is the first corporation organized under the general railroad act of the State of Connecticut, and we have had a tough time of it getting under way. So far as I know, Mr. Vanderbilt has nothing to do with this scheme. His plan is to go around by Springfield. We cut across the triangle, and go very nearly as the bird flies. The people along the line are anxious for the competition. They have been in much the same position as the people of New Jersey were under the old Camden & Amboy rule, when competing capitalists were anxious to get in, but could not."

CALIFORNIA RAILROADS.—Railroad surveying and the location of new lines is just now extremely active throughout the length and breadth of the Pacific Coast. The Central Pacific Company have four thoroughly equipped corps of engineers in the field, the Southern Pacific have two, and the California Central have ten. These are all engaged on the location and extension of overland lines, and do not include other small parties out surveying branch and local roads. The Central Pacific corps are locating a new overland line from Corinne, 25 miles west of Ogden, along the line of the 43d parallel through to the Missouri River. "The Union Pacific," remarked Mr. Crocker, the other day, "say they are going to have a through line of their own to the Pacific. We have no objection, but two can play at that game. Before they get to the Pacific we will be on the Missouri." The first party surveys from Corinne, Utah, up the east bank of Bear River, then in an easterly direction between the 42d and 43d parallels to the South Pass in the Rocky Mountains, a distance of about 350 miles. The second party is locating the line from South Pass to the headwaters of the Niobrara River. This portion of the road will, for some distance, skirt the old emigrant route, through the Sweetwater country, north of the Black Hills, past Fort Fetterman, across the big bend of the North Fork of the Platte River, over Lieutenat Warren's route of 1855, and down to the headwaters of the Niobrara. "The engineer in charge," states Mr. Crocker, "has reported that a good line can be run through that country, with not over a 50-ft. grade." Another corps starts from the headwaters of the Niobrara, keeping along the dividing line of Dakota and Nebraska, due east, to the Missouri River. The terminus has not yet been decided upon. This latter portion of the road will pass through a good grain country, and will, it is maintained, be less liable to obstruction in winter from snow drifts than the route of the Union Pacific. All of these parties are fully equipped and consist in all of about 100 thoroughly experienced men Each corps is provided with horses and wagons for transporting the necessary instruments, tools, tents and provisions. The general and only instructions given to the engineers in chief is to make selection of what in their opinion they may deem the most direct route for a safe and unobstructed overland railroad. "When that road is completed," observed Mr. Crocker, "it will be the most direct and soundly-built Northern Transcontinental road on the Continent. It will be steel-railed throughout, well ballasted, and as perfect a road in every respect as money can make it. With it, in conjunction with the Southern Pacific, we will be in a position to offer the most favorable advantages to the trade of the northern and southern sections of the Pacific Coast, having a through route both ways. All our interests are on this coast and we never intend to forget it." This company have also surveyed a line from Kelton, Utah, to the Wood River Country, Idaho, and have still another party engaged surveying an extension of the Oregon branch of the Central Pacific lines from Redding north to the Oregon State line. On the Southern Pacific road two corps of engineers are out. A preliminary survey of that portion of the road traversing Texas was made two years ago. The line then surveyed has, excepting a few minor deviations, been adhered to. The first of the two corps of engineers now out is about 75 miles south of El Paso. At this point and along the course of the Rio Grande some difficult surveying has been encountered, but the location has now been definitely fixed and the rails are being laid as fast as possible. "When we have got to the other side of that difficult piece," added Mr. Crocker, "there is a clean stretch of over 300 miles where three miles of line a day can be built right straight along. Another building party is working up from the south, so that by the 1st of July next year, or the 1st of August at the latest, we will have the pleasure of driving the last spike in the through Southern road from San Francisco to New Orleans." Referring to new features in the Southern Pacific, Mr. Crocker said: "We are crystalizing the railroad experience of the last fifteen years in what we are now doing. The road is steel-railed right through; the greatest care has been exercised by competent men in locating the route, and the bridging and building are all of superior construction. It will be in every respect a first-class road, as complete in every detail as money can make it. The locomotives and cars have been built with a view to speed and comfort."—*Frisco Evening Bulletin.*